

CONFERENCE PROCEEDINGS

RAND

The Future of the Information Revolution in Latin America

*Proceedings of an
International Conference*

Gregory F. Treverton and Lee Mizell

National Defense Research Institute



Prepared for the
National Intelligence Council
as a contribution to the
Information Revolution project
within the DCI's
Strategic Estimates Program

20010912 045

CONFERENCE PROCEEDINGS

RAND

*The Future of the
Information Revolution
in Latin America*

*Proceedings of an
International Conference*

Gregory F. Trevorton and Lee Mizell

CF-166-1-NIC

National Defense Research Institute

The research described in this report was prepared for the National Intelligence Council. The research was conducted in RAND's National Defense Research Institute, a federally funded research and development center supported by the Office of the Secretary of Defense, the Joint Staff, the unified commands, and the defense agencies under Contract DASW01-95-C-0069.

ISBN: 0-8330-3017-5

RAND is a nonprofit institution that helps improve policy and decisionmaking through research and analysis. RAND® is a registered trademark. RAND's publications do not necessarily reflect the opinions or policies of its research sponsors.

© Copyright 2001 RAND

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from RAND.

Published 2001 by RAND

1700 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138

1200 South Hayes Street, Arlington, VA 22202-5050

201 North Craig Street, Suite 102, Pittsburgh, PA 15213-1516

RAND URL: <http://www.rand.org/>

To order RAND documents or to obtain additional information, contact Distribution Services: Telephone: (310) 451-7002; Fax: (310) 451-6915; Email: order@rand.org

Preface

The National Intelligence Council (NIC) is undertaking a systematic research and development program on broad, crosscutting issues for the next millennium; this constitutes the DCI's Strategic Estimates Program. One of these strategic estimates focuses on developing a better understanding of the future course of the information revolution throughout the world over the next 10-20 years.

The NIC has asked RAND to take the lead in this effort to chart the future course of the information revolution. As a major part of this effort, RAND is convening a series of international conferences on various aspects of the information revolution. The first of these conferences, focusing on societal trends driven by the information revolution, as they are unfolding in different areas of the world, was held in Washington, D.C., in November 1999. The proceedings of this conference were published in Hundley and others (2000). The second conference in this series, focused on the technology drivers of the information revolution, was held in Pittsburgh, Pennsylvania in May 2000. The proceedings of that conference were published in Anderson and others (2000).

The third conference in this series, focused on the information revolution in Latin America, was held in Washington, D.C., in November 2000. This report contains the proceedings of this third conference. For sharpness of presentation, it presents most arguments as statements, not as "one participant argued." Often, arguments were overstated for effect, to provoke thought, and this report points out those instances.

This research is sponsored by the National Intelligence Council, and monitored by the National Intelligence Officer (NIO) for Science and Technology. It is being conducted by the Acquisition and Technology Policy Center of RAND's National Defense Research Institute (NDRI). NDRI is a federally funded research and development center sponsored by the Office of the Secretary of Defense, the Joint Staff, the defense agencies, and the unified commands.

Contents

Preface	iii
Figures	vii
Tables	ix
Summary and Reflections.....	xi
Acknowledgments.....	xxiii
1. Introduction.....	1
2. Surveying the Latin American Infrastructure.....	5
3. The Economic and Business Dimension	15
4. Information Revolutionaries	23
5. Small Group Discussion: Economic and Business Dimension.....	27
6. The Political Dimension.....	33
7. The Societal Dimension.....	39
8. Small Group Discussion: Political and Societal Dimensions	43
9. Looking Forward	49
Appendices	
A. Conference Participants	53
B. Conference Agenda.....	57
Bibliography	61

Figures

Figure S.1 Number of Internet Users Worldwide, October 2000.....	xii
Figure S.2 Internet Users per 1,000 People Worldwide.....	xiii
Figure S.3 Internet Hosts in Latin America per 1,000 Inhabitants, 2000.....	xiv
Figure S.4 Internet Penetration in Mexico	xvii
Figure S.5 International IP Links	xxi
Figure 2.1 GDP Per Capita (USD \$), 1998	6
Figure 2.2 Number of Internet Users Worldwide, October 2000.....	7
Figure 2.3 Internet Users as Percent of Population in Latin America, 1999....	7
Figure 2.4 Internet Hosts in Latin America per 1,000 Inhabitants, 2000.....	8
Figure 2.5 Projections of Latin American Online Commerce, 1999-2005.....	8
Figure 2.6 International IP Links	9
Figure 2.7 International Internet Links (mbps)	10
Figure 2.8 Telephone Main Lines per 100 People in Latin America, 1999	11
Figure 2.9 Cellular Subscribers per 100 Inhabitants, 1999	12
Figure 3.1 Internet Penetration in Mexico.....	18

Tables

Table S.1 IT Penetration in Mexico by Access Device (% of population)	xvi
Table 3.1 IT Penetration in Mexico by Access Device (% of population).....	15
Table 3.2 New Economy Startups Covering Mexico.....	19

Summary and Reflections

The information revolution is bringing about profound changes in the globe's political and economic life. RAND has embarked on a multi-year effort, sponsored by the National Intelligence Council, to chart the future course of these changes over the next 10-20 years, around the world. As a major part of this effort, RAND is convening a series of international conferences on various aspects of the information revolution. The third conference in this series, reported on here, was held in Washington, D.C., on November 1-2, 2000, focusing on the information revolution in Latin America.

The information revolution is so entwined with the global economy that this conference's discussion about the future of information technology (IT) in Latin America often became a conversation about Latin America's prospects in the emerging global economy. Indeed, the major issues are the same for both subjects:

- the role of government and of the large incumbent, and sometimes protected, local firms;
- the nature of connections to the richer countries, especially the United States, and to their technology, capital and companies; and
- the need to train and retain skilled people, which begins with education but runs far beyond, to safety and living conditions that will attract real or potential "brain drain" by comparison to New York, Miami or Silicon Valley.

So, too, Latin America's challenge in IT is the same as for the global economy: how to, first, get on, then move up the value chain from simple processing – such as Intel's chip-making in Costa Rica – to higher value-added manufacturing or services. Yet it is easy to blur the distinction, as this discussion sometimes did, between "producing" IT and "using" IT effectively to improve other industries. The IT revolution might be thought of in three categories:

- Creating technology;
- Embodying that technology in products or "artifacts"; and
- Offering and using services based on the artifacts.

Certainly, not all Latin American countries can or need to create technology or products to be successful. Not all need to develop IT industries. Perhaps none need to do so. The temptation to think that "making things" is necessary can easily lead to a slippery slope of protectionism and heavy-handed government intervention. Most of the gains from IT will be in services, not objects, in using IT to become more competitive across the board.

Latin America in a Global Context

The subject is not just the Internet or the World Wide Web but the entire range of technologies that are reshaping communications, and the implications of those technologies for business and the economy, politics and governance, and ultimately for how societies organize. The impact of the information revolution touches all of society, and so the different dimensions cannot really be separated. For instance, the role of government is eminently political but also is critical to the business environment. A social dimension, like education, also is at the heart of countries' economic and business opportunities in information technology.

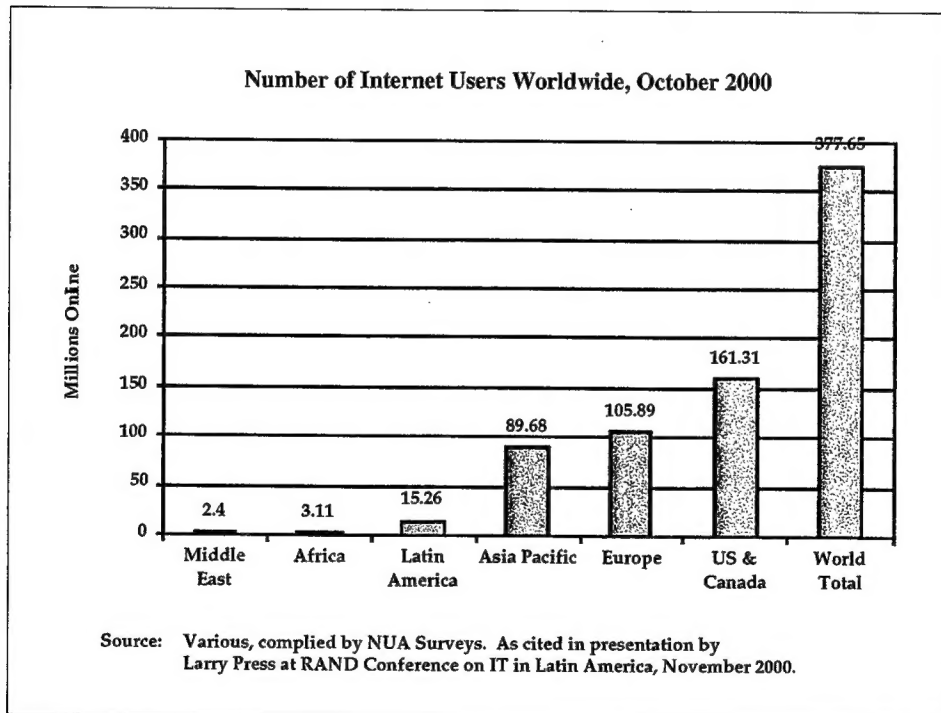


Figure S.1 Number of Internet Users Worldwide, October 2000

As shown in Figures S.1 and S.2, the Internet came late to Latin America, and, while its penetration in that region is still small relative to that in the rest of the world, it is growing rapidly. Only 1.5 percent of Latin Americans have access to the Web today, versus 24 percent of North Americans. Internet penetration is projected to still be less than 12 percent in Latin America in 2005, and most of this penetration will be in the richest 20 percent of the Latin American population, about 100 million people in total. Still, the numbers of end users and host computers are growing faster than the world average.

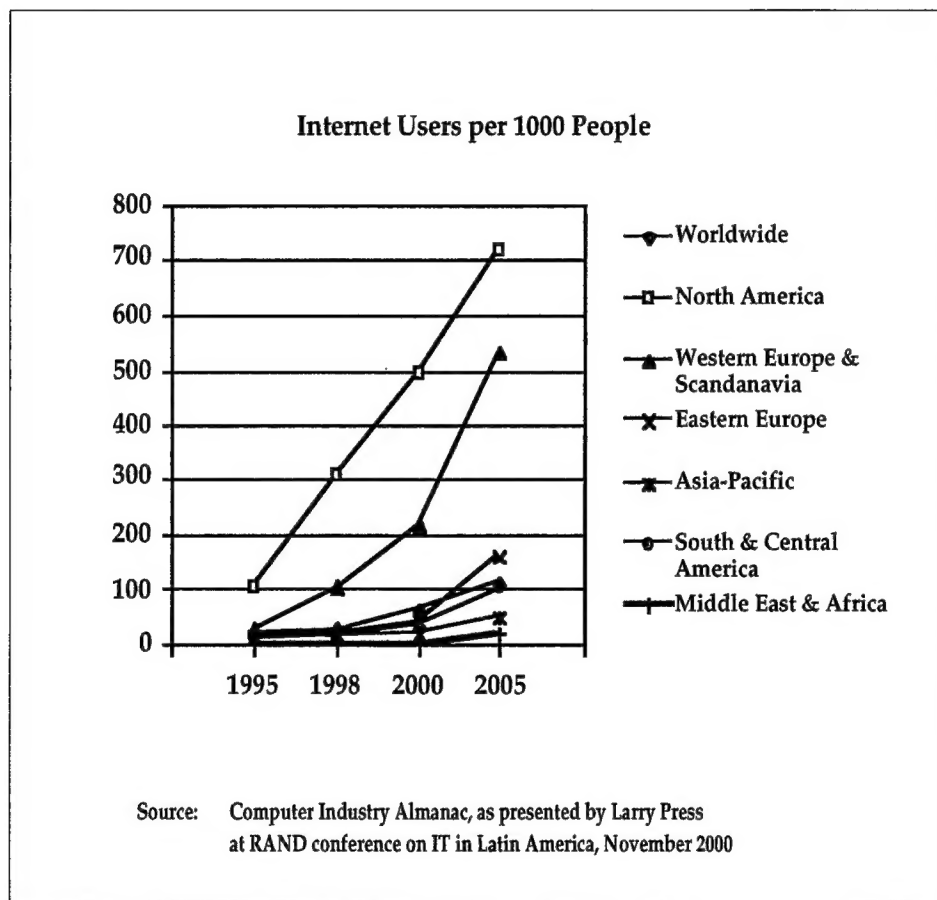


Figure S.2 Internet Users per 1,000 People Worldwide



Figure S.3 Internet Hosts in Latin America per 1,000 Inhabitants, 2000

For the information revolution, as for roles in the global economy more generally, there is no "Latin America." Differences across the region are vast, as shown in Figure S.3. Illustratively, the countries might be divided into three groups:

- the "leaders" – Mexico, Brazil, Argentina, Chile and Uruguay;
- the interesting, successful "outliers," like Costa Rica or some of the Caribbean islands, and
- the rest.

These variations across the region notwithstanding, its countries face many similar problems in addressing the information revolution, and they seem unlikely to solve many of them by mimicking the approaches of the world's IT

leaders. For instance, e-commerce has been slow to develop not just because few people are online but also because, in varying combinations, few people have credit cards with which to pay; there is little infrastructure for delivering purchases; and trust in procedures for paying for and getting goods is lacking. Pre-paid cell phone or "smart" cards have been one way around some of these obstacles.

Outside major cities, the information revolution will not come to Latin America with hard wires and modems. It will come with new, wireless technologies, though those will hardly be a panacea. There are, for instance, 100 cellular providers in the region, but, alas, half of the phones are still analog. Third generation cellular phones will communicate at 3 mbps (384 kbps in a moving vehicle), but will not be available in Latin America -- or the United States -- for several years. Moreover, some places will remain hard to reach with cellular technology. Satellite links also hold promise; the cost of a local ground station to serve communities or educational institution is now on the order of \$6,000, and in Peru there are now 700 *cabinas públicas* (public outlets, or kiosks) -- a franchise operation serving local communities.

The Case of Mexico

Mexico is particular in its connection to the United States and in the power of its dominant incumbent telephone company, Telmex, but it does display most of the issues common to the region's more advanced IT countries. As an aside, the parallels between the Internet today and the railroad boom of the nineteenth century are intriguing. Railroad building in Mexico accounted for half of total economic growth, and there was talk of "railway time" and the "death of distance." Then, as now with the "digital divide," the growing disparity of wealth that resulted from railroad building was cause for concern; owned by foreigners or local oligarchs, railroads generated growth but worsened the income distribution. In Mexico, the backlash against this social impact of the railroads contributed to the Revolution of 1910. The railroad bubble burst, and Mexico has built hardly any railroad track since.

Mexico has 100 million people and a GNP of about a half-trillion dollars, or about a twentieth that of the United States. Its population is young, with seventy percent under 35 years of age, and the income distribution is skewed, with the top twenty percent of the population accounting for 58 percent of income (about the same, however, as in the United States). As Table S.1 shows, that top 20 percent of the population is much more penetrated by the various communications technologies than are Mexicans in general.

IT Penetration in Mexico by Access Device (% of population)		
	Total (%)	Richest 20% (%)
Fixed lines	11.5	33.4
Wireless	7.6	22.0
Total lines	19.1	55.5
PC	5.6	16.2
Internet (estimate)	1.6	4.6
TV	87.0	100.0
Cable TV	11.0	31.9
Source: Telmex, Goldman Sachs, and author, as presented by Timothy Heyman at RAND Conference on IT in Latin America, 2000		

Table S.1: Internet Penetration by Access Device

As shown in Figure S.4, current trends suggest exponential growth in Web access, from the current one-percent penetration among homes and slightly higher penetration among businesses to approximately 18 percent among homes and 26 percent among business by 2010. This growth, however, is likely to be concentrated among the richest 20 percent of Mexicans.

Mexico's companies that are relevant to IT can be divided into seven categories -- connectivity providers, old economy incumbents, Telmex, the media, banks, new economy start-ups, and global Internet companies. Telmex stands out. It monopolizes the "last mile" of wire to the consumers, controlling 99 percent of local telephones. It has more flexibility than the incumbent telephone companies in other Latin American countries, which either had to develop their Internet strategies outside their corporate structure, or were legally barred from becoming Internet service providers (ISPs), as in Brazil. In Mexico, Telmex currently controls 58 percent of all Web accounts. It accounts for a third of the Mexican stock market, and it is controlled by one man -- Carlos Slim, Latin America's wealthiest businessman, who also owns Prodigy Inc., the third-largest ISP in the United States, and who recently bought CompUSA.

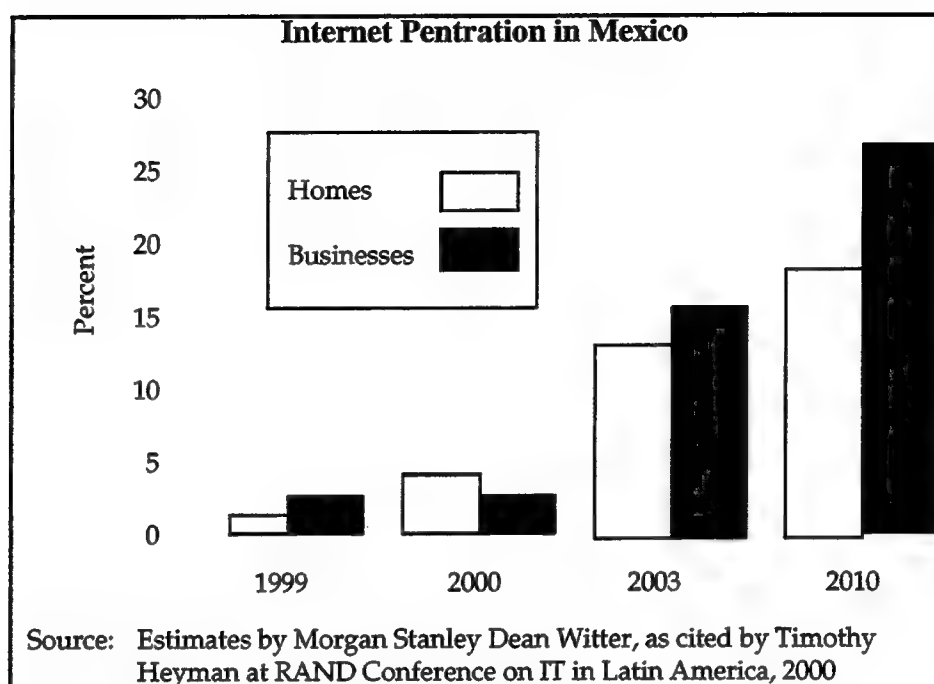


Figure S.4 : Internet Penetration in Mexico

Telmex aside, the obstacles to the development of IT and e-commerce in Mexico are familiar across the region. There are few Internet start-ups, and, especially given the problem of financing, most of those are organized outside the country even if they intend to conduct business in Mexico. The 125 firms in Mexico's own "Silicon Valle," (valley), where IT start-ups are beginning to thrive, are all, like the railroads a century ago, foreign-owned -- four-fifths American and the rest Asian. Global Internet companies have a presence in Mexico, but neither Mexico nor Latin America more generally is a priority for them. Advertising on the Internet has yet to take-off as a revenue source, and Internet connectivity as a revenue stream is dominated by Telmex. There are 44 other ISPs in Mexico, but the fact that they have, on average, fewer than 200,000 subscribers each suggests future consolidation among providers.

E-commerce is hampered, as everywhere in Latin America, by how to pay and how to deliver. In Mexico the problem is not the lack of credit cards, for the country has some eight million, but there is nothing comparable to the U.S. sales tax advantage in buying online. For these reasons, business to business e-commerce (B2B) is more promising than business to consumer e-commerce

(B2C). Mexico does have one important "pull" factor that is unique to it. The just-in-time inventory needs of the *maquiladoras* -- processing operations, mostly in consumer electronics, whose inputs can be imported duty free provided all the products are exported -- on its northern border provide a powerful incentive to use IT. Foreign direct investment in the country has grown from \$4 billion annually to \$13 billion since NAFTA, the North America Free Trade Agreement, came into effect in 1995.

The Successful "Outliers"

Costa Rica and some of the island states in the Caribbean -- the Cayman Islands, the Bahamas, St. Barts, Aruba, the British Virgin Islands, and the U.S. Virgin Islands -- are notable in being further along, not in making but in using IT. These outliers share several preconditions: their governments are founded on trust and transparency; they have a well-established rule of law, high literacy rates, economic cultures in which business can prosper, populations that are fluent in English (in Costa Rica's case, tolerable working knowledge), and, perhaps most important, political stability. The islands demonstrate that it is not necessary to produce IT to use it effectively, and that even small countries can do so. Their IT advances were driven by the needs of their commerce -- tourism and banking, including, unfortunately, money laundering.

In attracting Intel, Costa Rica took political risks, like committing to teach English in primary schools. Intel now accounts for a sizeable fraction of the country's economy. The country is thus involved in producing, or at least assembling, IT artifacts, but its tourism industry has also been a driver of IT use. It has the advantage of a world-class business school, INCAE, which was founded with assistance from the Harvard Business School.

Creating Niches...and the Skilled People for Them

In talking about the need for human capital, the conversation about IT becomes very much that about economic progress more generally. It takes skilled people to use IT, much less produce it, but the same is true for many other aspects of economic life. In much of northern South America, skilled people who can leave, do leave, most often for the United States. They are pushed out by violence, by the lack of opportunities and by populist politics that discourage innovation and individual enrichment. In the process, Miami is becoming a kind of economic and cultural "capital" of Latin America. Given the large market for Spanish-

language content, not only in Latin America but also throughout the entire Spanish-speaking world – only 2 percent of Web content is now in Spanish – the region has the opportunity to produce content. Yet it will have to compete with Miami, which now has advantages in infrastructure and financing.

Education is a primary obstacle to narrowing the income gap in Latin America. Dropout rates are high, repeat rates in primary school are very high, teaching materials are outdated, and the worst teachers are in the primary schools. At the university level, teachers are ill paid, and so moonlighting and part-time teaching are the norm. Unions and bureaucracy create barriers to innovation, and the upper classes send their children to private schools.

There are, to be sure, some points of excellence. Mexico is noted for UNAM (Universidad Nacional Autónoma de México, or Autonomous National University of Mexico), as well as the Monterrey Technical Institute, which has 27 branch campuses and an innovative virtual learning program. Brazil stands out for its university-related incubator programs and growing indigenous venture capital market, while Chile has its secondary school *Enlaces* (links) program that will eventually introduce more IT-interested students into the already successful higher education system. Biological science and agriculture are strengths in both Argentina and Uruguay.

Government and IT, and Vice Versa

The role of government is critical to the development of IT, and government and politics will in turn be reshaped by the information revolution. The United States has taken the global lead in IT with a government role mostly confined to staying out of the way. The process might be labeled, in Joseph Schumpeter's words, "creative destruction."¹ In contrast, many Europeans would prefer a more predictable, more controlled, government-led process. Latin America seems somewhere in the middle, moving toward the U.S. model but with strong vestiges of state intervention. Latin America's best and brightest now go to study in the United States, not Europe as in former times, and the faintly Marxist cant against business and business schools has waned.

But might Latin American governments again enact high barriers to make sure that foreign companies don't overwhelm the domestic companies as they did in the 1970s? Will information entrepreneurs in the region want governments to

¹ See Schumpeter (1942), particularly pp. 81-86, for the original statement of the "creative destruction" thesis.

stay out of the way or protect them? The answers are directly related to assumptions about the role of IT in development more generally. If growth is believed to ensue because countries *make* IT products, the policy logically becomes one of protection and import-substitution. Instead, if growth is believed to result from *using* IT products, then import-substitution is inappropriate. The temptation to make things is giving import substitution some renewed favor, for better or worse.

Governments are relatively larger in Latin America than in the United States, and thus they will be important users of IT. Brazilians can vote online, and sixty percent of Brazilian income tax returns are filed online. Yet, on the whole, the region's governments have taken a "fiscal," rather than a "consumer," approach to IT; taxes and duties have kept prices high – and so computers costs twice as much in Venezuela as in the United States. Governments pay lip service, but seldom much more than that, to IT as a means of increasing the transparency of governance. And advertisers are not willing, in many countries, to support media, either traditional or new, that oppose ruling governments.

As governments learn about the potential dangers of the Internet (to them), they may attempt to move against it in various ways, but they will also face sharp limits on how much they can control information flows. A recent case is suggestive of those limits. When Venezuelan president Hugo Chavez made a deal with Cuba's Castro, many of the deal's provisions – like bartering Venezuelan goods for Cuban doctor and other professional services – were questionable in the norms of international trade. The Venezuelan government was able to suppress details of the deal from traditional media, but those details did leak out via the Web.

North-South Connections

The hub-and-spoke configuration of fiber optic cables is a metaphor for Latin America's connections to the richer countries, especially the United States. As shown in Figure S.5, those cables link Latin American countries to the United States, not to each other. The metaphor evokes concerns regarding national security and national autonomy – powerful echoes in Latin American history. Yet in the short run, the main concern about the cable configuration is price, and it is not obvious that the current arrangement is more expensive than a string of low-traffic cables around Latin America would be, quite the contrary.

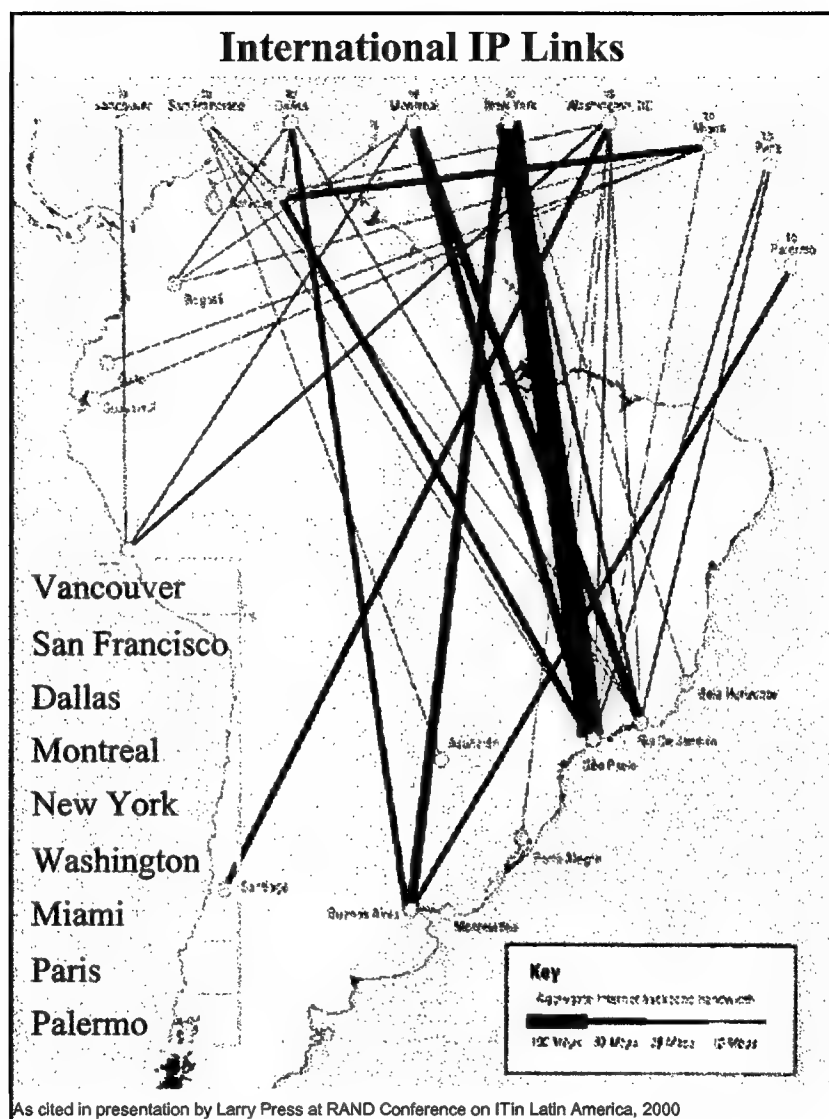


Figure S.5. International IP Links

Prices will come down, as photonics make possible a several order of magnitude increase in bandwidth.² Yet if that advance, like previous ones, is exploited fastest in the United States and Europe, they may jump ahead again, leaving Latin America just as far behind, perhaps even further. Latin America didn't close the gap during the industrial revolution, so is there any reason to believe

² This is discussed in Anderson et al (2000).

that it might during the information revolution? Thus, it doesn't take a commitment to 1970s style "dependence theory" for a Latin American to worry that the existing global "game" is rigged against it.³ If Latin America becomes more and more integrated in a U.S.-led global economy, it may be able to have a piece of the action; but can it have its own action? Can any country in the global economy? Is it such a bad thing that all the cable lines run north and south, if Latin America is trying to develop technologically? If the region is to integrate into a global economy, its technical people have to be connected to those at the top of the game, and that top is now Silicon Valley.

Mexico decided through NAFTA that it couldn't escape the United States and so should benefit from the U.S. economy as best it could. It weathered the financial crises of the 1990s better than other regions because it was so closely tied to a booming U.S. economy. Other nations will not choose or be able to connect themselves so directly to IT's dominant nation.

Desires for national or regional autonomy will persist, and they will continue to lure Latin American nations in the direction of policies, like protection and import substitution, that are destined to fail. In the world of the global information economy, to opt out is to opt for poverty. Autonomy does not mean disconnecting but, rather, trying to structure connections to the global economy in a way that will provide maximum advantage to the nation and its citizens.

³ By this theory, the structure of international economics advantaged the industrial countries at the center and destined the poorer ones on the periphery to a dependent position. The terms of trade ran against the latter's agricultural and mineral exports, and their ability to move up the ladder to more capital-intensive production was limited by the structure and operations of multilateral corporations, especially with regard to technology transfer, the availability of capital, and the co-opting of elites from the periphery by the companies and institutions of the center. See, for instance, Cardoso and Faletto (1979). For a critique, see Packenham (1992).

Acknowledgments

This conference on "The Future of the Information Revolution in Latin America" was very much the product of a group. To encourage frankness at the workshop, we promised not to generally attribute particular arguments to specific participants. That, however, carries the risk that our colleagues will not get appropriate credit for what follows. Here, we aim to remedy that. If one co-author can acknowledge the other, Lee Mizell's organizing for the workshop ranged from grand substance to grubby details, none too small. She was both impressive and a pleasure to work with.

Larry Press worked closely with Lee in preparing basic information on infrastructure, demographics, and the penetration of various information technologies. Only some of that good work could be included here, and we want both to thank Larry and to indicate that more is available on his website, at <http://som.csudh.edu/depts/cis/lpress/>. The other discussion provokers were Timothy Heyman, Ricardo Setti, Ernest Wilson, Diego Arria, Antonio Botelho, Elliot Maxwell, Robert Vitro, Juan Enriquez, and Susan Kaufman Purcell. We thank them all. We particularly appreciate the preparation that Timothy Heyman and Ricardo Peon gave to the Mexican case.

Several of our RAND colleagues are identified in the report – Dr. Richard Hundley, Dr. Robert Anderson and Dr. Tora Bikson. We benefited from their participation and their comments, and we thank them for being such good colleagues. We are also grateful to several other RAND colleagues, not mentioned in the report: Dr. C. Richard Neu was characteristically tart and thought provoking in his comments, Dr. Angel Rabasa's notes were invaluable in making a good conversation even better, and Dr. Philip Anton's review further sharpened the report's logic and its prose. Craig Barela did the final formatting of the report.

We express our appreciation to all these people and, again, to all of the workshop participants, who are listed in Appendix A.

Dr. Gregory F. Treverton
Conference Chairman

1. Introduction

Chair: Gregory Treverton, RAND

What are the prospects for and implications of information technology in Latin America? What will be the state of the information revolution in the region in ten to fifteen years? These questions were the themes of a RAND workshop on the information revolution in Latin America held on November 1-2, 2000, in Washington, D.C. Information technology (IT) was defined not just as the Internet or the World Wide Web, but also the entire range of technologies that are reshaping communications – and their implications for business and the economy, politics and governance, and ultimately for how societies evolve.

This workshop was part of a larger project, one asking about the future of the information revolution around the globe. RAND's efforts to address related issues are expected to extend over a three-year period. The first step in this effort was a conference held in November 1999 on the political, economic, social, and cultural trends driven by the information revolution as they manifest themselves globally; the proceedings of this conference were published in Hundley and others (1999). The second step was a conference in May 2000 to explore the technological drivers of the revolution in more detail; the proceedings of that conference were published in Anderson and others (2000). The workshop on Latin America represented a third step toward RAND's over-arching goal of mapping the likely future of the global information revolution over the next one to two decades. This report presents the proceedings of that workshop.

Thirty individuals participated, bringing expertise from business, government, academia and think tanks across the region.⁴ The agenda for the workshop was:

- the likely diffusion of the information revolution in the region;
- the economic and business realities in which that process is embedded;
- the extent to which political considerations will spur or constrain the process and, in turn, will be reconfigured by it; and
- the broader impact of the process on Latin American societies.

⁴ Participants' names and affiliations are included in Appendix A.

The workshop sought to give special attention to how the impact of the information revolution might vary within Latin America, as well between Latin America and the rest of the world.

The workshop began with an overview of information technology infrastructure in the region. This session asked: What is the profile of IT infrastructure across Latin America? What are the dominant features of that infrastructure across countries? Which countries are leading, which are lagging? What are the predominant differences across countries? Section 2 of this report summarizes this discussion.

A discussion of the economic and business dimension of the information revolution came next, with particular emphasis on the region's two biggest countries, Mexico and Brazil: What are the sources of financing for IT and for new IT-enabled businesses and services? Who are the major players? Are there critical IT business clusters in the region? Where, and why have they developed? How is e-commerce developing in the region? What are the main differences across countries? What are the driving forces of change? What are the main obstacles? Ultimately, what can be said about the impact of IT on the conduct of business and economic advance in the region? A keynote address on "Information Revolutionaries," by Ernest Wilson of the University of Maryland, followed this discussion. The plenary session and keynote address are summarized in Sections 3 and 4, respectively.

Section 5 summarizes three breakout groups addressing how the impact of the information revolution might vary across the region. Each group dealt with a different subregion of Latin America – Mexico, Central America, and the Caribbean; Northern South America; and the Southern Cone, including Brazil. The first day of the workshop wrapped up with a discussion of the political dimension of information revolution, summarized in Section 6.

Section 7 deals with the first plenary session on the second day of the workshop, addressing the societal dimensions of the information revolution: How will IT affect delivery of health care, education, and other social services? What social or cultural factors prominent in Latin America, if not necessarily unique to it, facilitate or inhibit the diffusion of information technology? How common are these factors across the region? Is the information revolution increasing economic inequalities in the region? Is it increasing social inequalities in this or other ways, for instance by accentuating rural-urban cleavages?

Before wrapping up the workshop, breakout groups again grappled with differences across the region, focussing on the political and societal dimensions, and this time with each group dealing with all of Latin America. Those

discussions are presented in Section 8, and the workshop's major themes and conclusions are laid out in Section 9. Two days are hardly enough to fully apprehend the current state of the IT revolution, much less its future, but the workshop did outline a provocative menu of provisional conclusions.

2. Surveying the Latin American Infrastructure

Discussant: Larry Press, California State University

The Internet made a late start in Latin America and was introduced primarily through the region's universities -- which formed ENRED ("on the Net," or "connected"), an association of networks, in 1991. Since 1991, ENRED has met eight times, although not since 1998. Efforts to form a Latin American Network Information Center and assign IP numbers in the region have yet to succeed. Yet, while the Internet came late to and is still small in Latin America, its growth is impressive. Between 1999 and 2000, international bandwidth in the region increased 47 percent, from 48.3 mbps to 71.0 mbps. While these figures are dwarfed by increases in the U.S./Canada and Europe (178 percent and 102 percent, respectively), the bandwidth increase in Latin America in recent years is notable: In October 1996, for example, only Mexico had an international Internet connection exceeding one mbps.

Latin America, including the Caribbean, is extremely diverse in economic development and in both technological and socioeconomic infrastructure. Figure 2.1 presents one measure of this diversity, showing the range of GDP per capita across Latin America. Another measure of this diversity is the Human Development Index (HDI), developed by the United Nations Development Program. The HDI ranks countries in terms of life expectancy, educational attainment and adjusted real income. Predictably, within Latin America, Argentina, Chile, and Uruguay, along with Mexico and Venezuela, rank higher than Peru, Ecuador, Colombia, and most of the countries of Central America.⁵

⁵ The 1999 HDI rankings of the Latin American nations are presented in UNDP (1999).



Figure 2.1 GDP Per Capita (USD \$), 1998

There are grounds for skepticism about all numbers, including the HDI, and because IT is growing so fast, numbers about it are especially suspect. For instance, the "number of Internet users" throughout the region is widely cited. Nua Internet Surveys estimates that approximately 15.3 million Latin Americans were online in October 2000 (as shown in Figure 2.2); the Computer Industry Almanac projects that Latin America will have approximately 100 Internet users per 1000 individuals by the year 2005.

But what constitutes a user? Is an Internet "user" someone who logs on twice a year? One count had 15 million users in Latin America, but another at the same time found 14 million in Brazil alone. There is no common definition of "user," and most surveys, including those cited here, collect what news and other reports are available. With this in mind, comparisons are probably safer than any point statistics. The safest conclusions are that: (a) Latin America is a very diverse region, in general; (b) users and hosts in Latin America are small in comparison to the rest of the world but growing rapidly; and (c) differences in IT among Latin American countries are striking. The southern cone, plus Mexico, is the (relative) advance guard. Figures 2.1 through 2.5 demonstrate all three of these points.

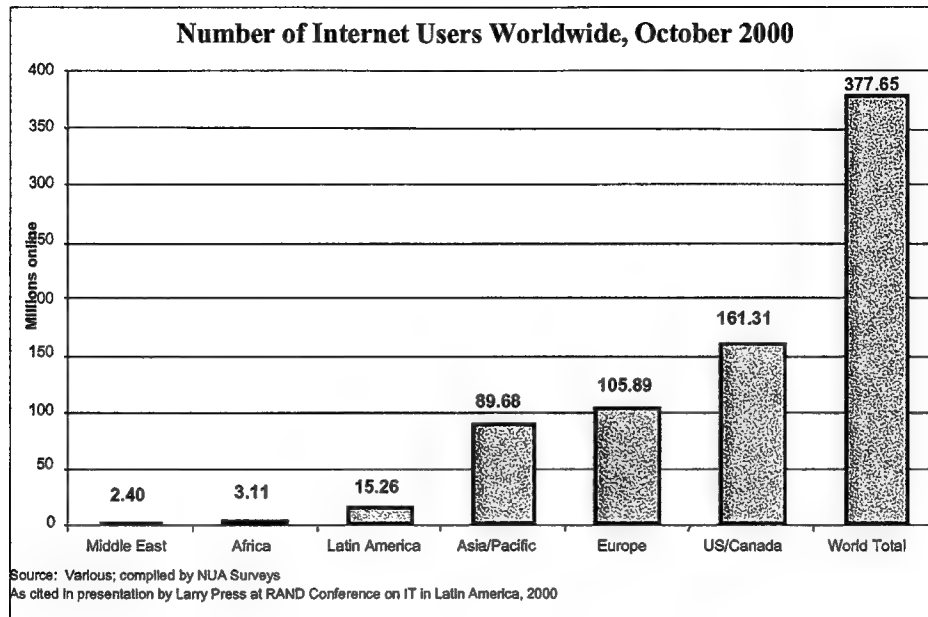


Figure 2.2 Number of Internet Users Worldwide, October 2000

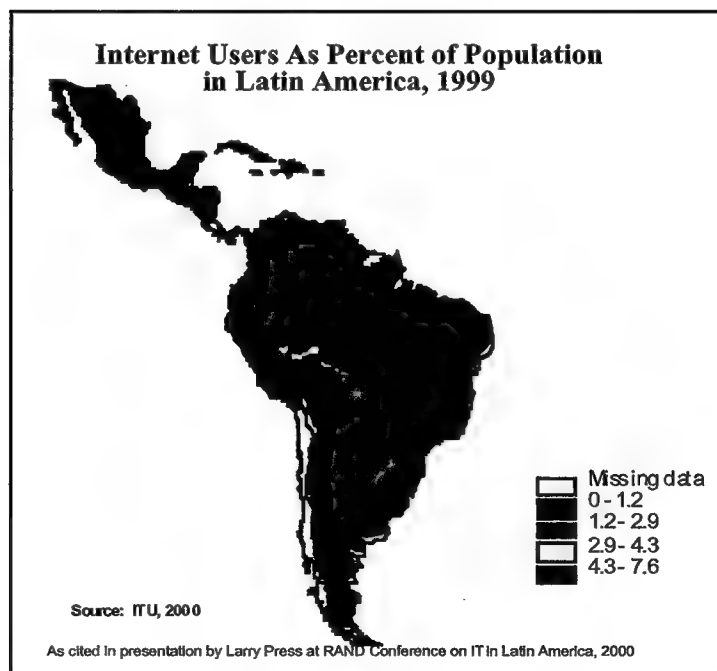


Figure 2.3 Internet Users as Percent of Population in Latin America, 1999

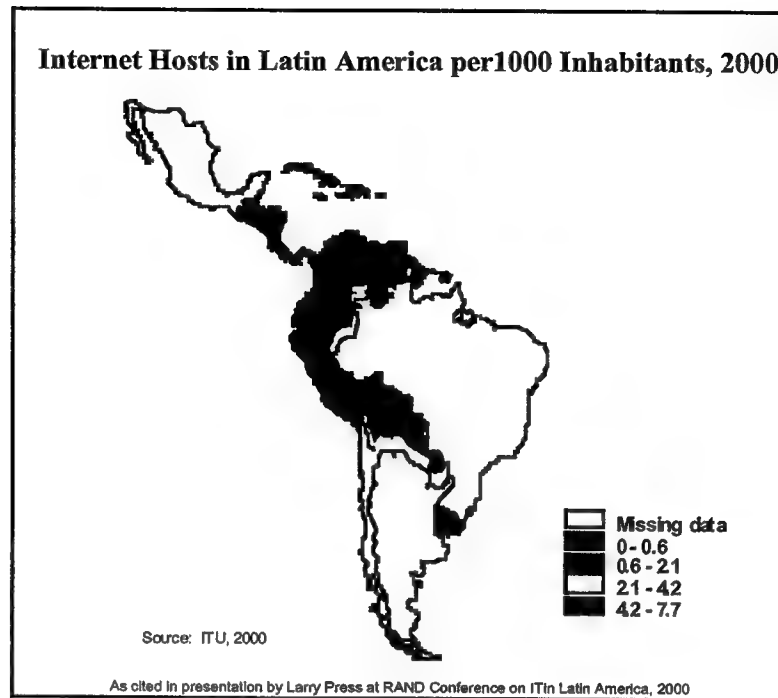


Figure 2.4 Internet Hosts in Latin America per 1,000 Inhabitants, 2000

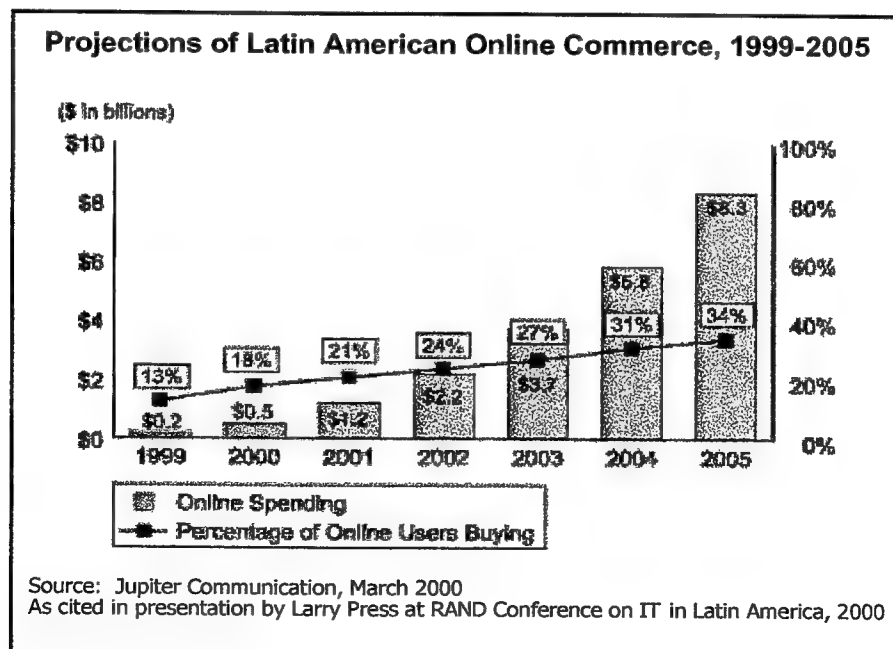


Figure 2.5 Projections of Latin American Online Commerce, 1999-2005

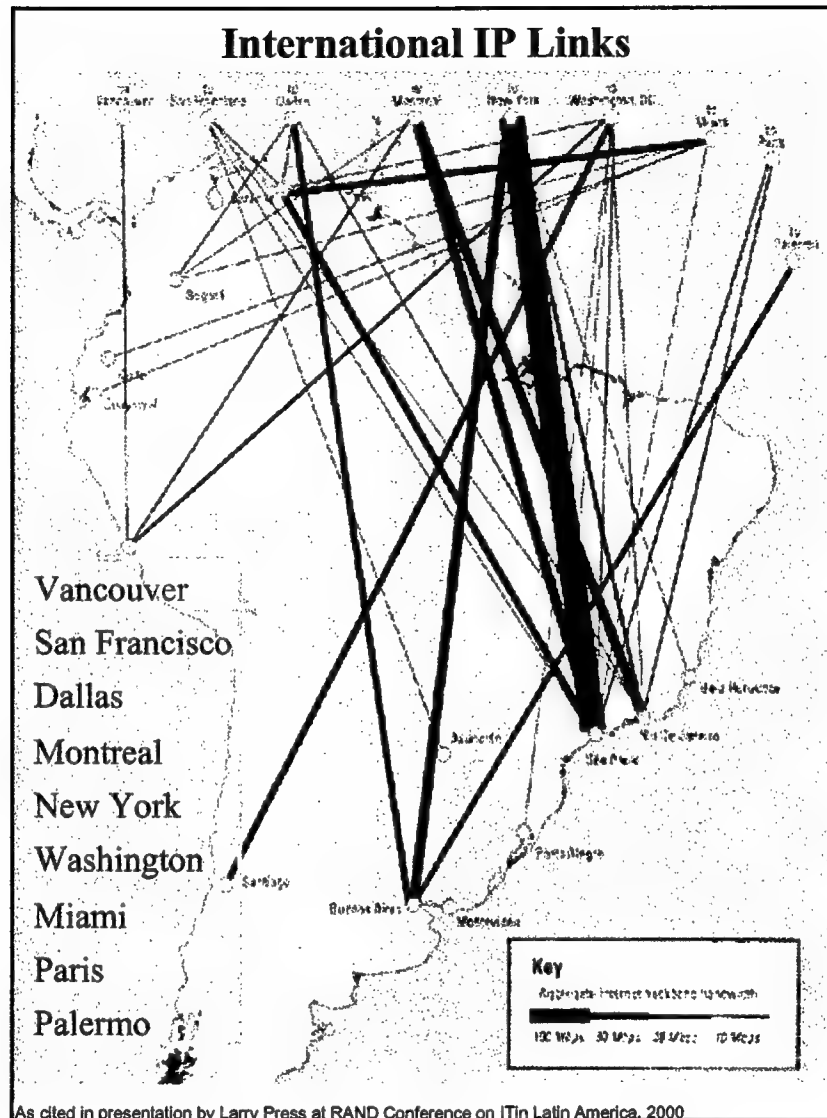


Figure 2.6 International IP Links

Bandwidth is an intriguing and important topic. On one hand, given the new fiber optic cables that are under construction or planned, bandwidth should be much less a constraint, making possible a surge in connectivity for the region. It might even have a bandwidth "glut." On the other hand, as shown in Figures 2.6 and 2.7, those cables link Latin American countries with the north, especially the United States, and with Europe, not one to another. Does the shape of those connections matter? It surely evokes concerns regarding national autonomy and security – powerful echoes in Latin America. In the short run, the main obstacle

to greater bandwidth access is price, and it is not obvious that the current hub-and-spoke arrangement of cables is more expensive than a string of low-traffic cables around Latin America would be. Prices will come down, as photonics make possible a several order of magnitude increase in bandwidth.⁶ Yet if that advance, like previous ones, is exploited fastest in the United States and Europe, they may jump ahead again, leaving Latin America just as far behind, perhaps even further.

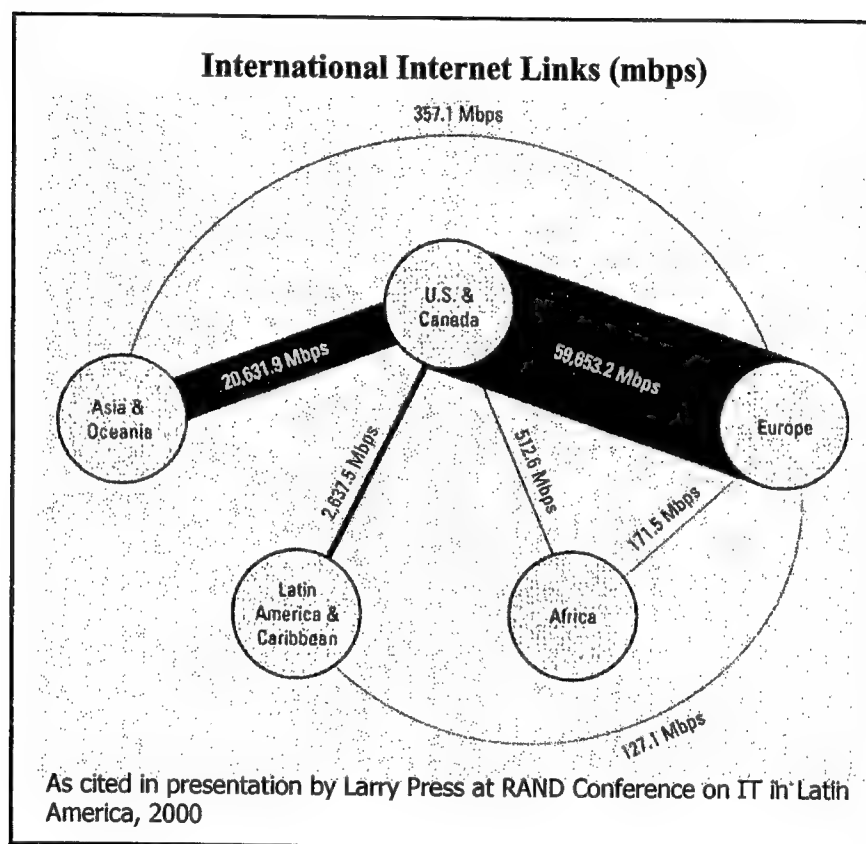


Figure 2.7 International Internet Links (mbps)

So, too, local access to the Internet and to other communications is both limited in the region and varied across it, as suggested in Figure 2.8, which shows the number and distribution of telephone main lines across Latin America.

It appears that if Latin America is to catch up, it will have to "leapfrog"; simply following the approaches taken by the United States and Europe will not let it

⁶ This is discussed in Anderson et al (2000).

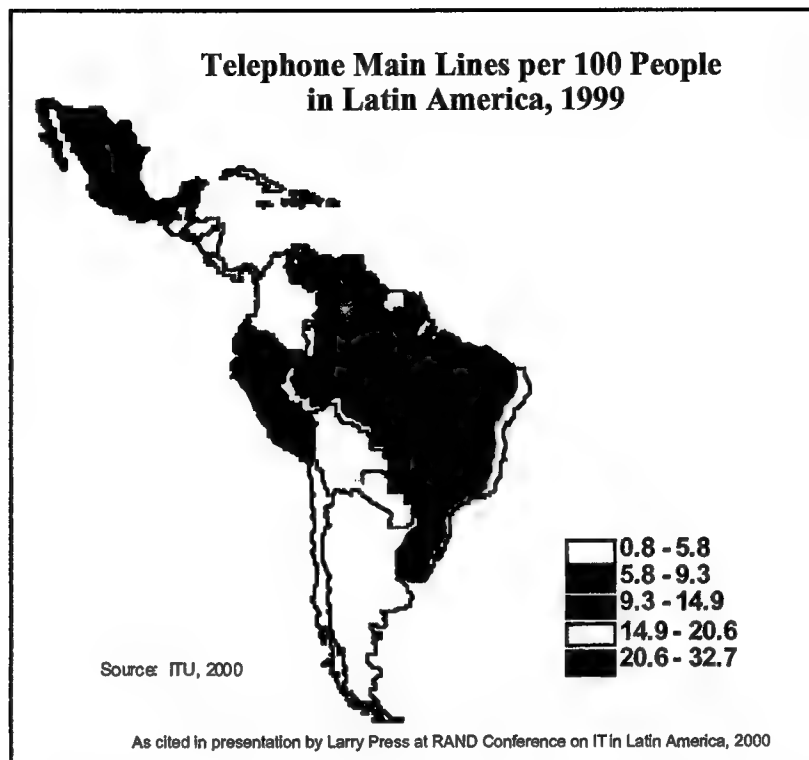


Figure 2.8 Telephone Main Lines per 100 People in Latin America, 1999

catch up with other parts of the world. New, wireless technologies may allow penetration into rural areas at a rate far faster than hard-line systems and modems would allow. (Figure 2.9 shows the current number and distribution of cellular subscribers in Latin America.) Still, while wireless technologies hold promise, they will hardly be a panacea. There are, for instance, 100 cellular providers in the region, but, alas, half of the phones are still analog. Third generation cellular phones will communicate at 3 mbps (384 kb/s in a moving vehicle), but will not be available in Latin America for several years. Moreover, some places will remain hard to reach with cellular technology.

Another technology that offers potential benefits for Latin America is satellites, in both geostationary (GEO) and low earth orbits (LEO). In contrast to recent failures, Tachyon and other companies intend to provide Internet connectivity, including voice over the Web. While such technology holds promise, there are still technical as well as regulatory problems to be overcome. The local telecom companies oppose the proliferation of voice-over technology. Of three companies providing LEO technology in the region, two are bankrupt and the third company is approaching bankruptcy – indicating pitfalls with the existing

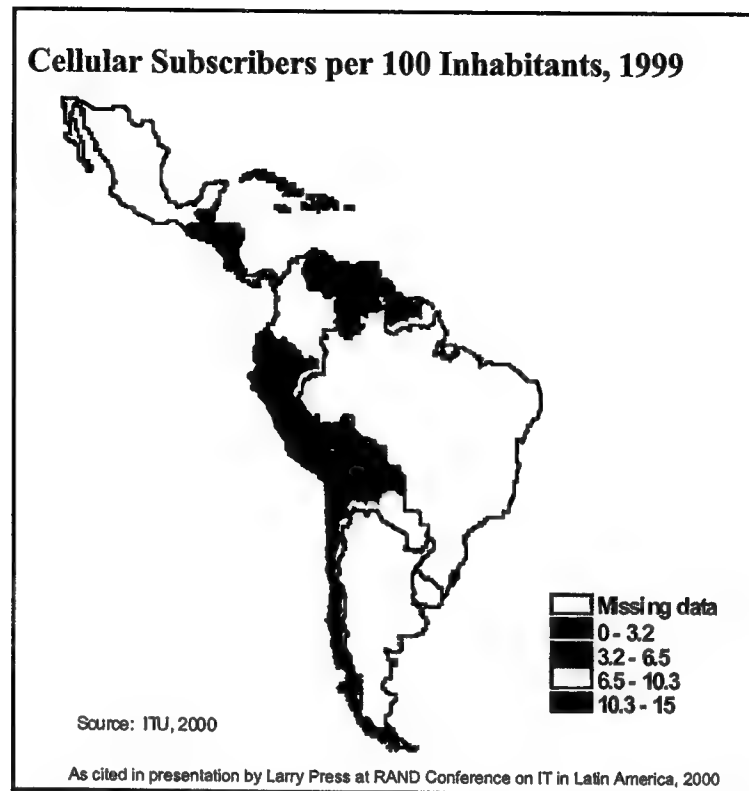


Figure 2.9 Cellular Subscribers per 100 Inhabitants, 1999

business model. The good news is that the cost of a ground station to serve a local community, community access centers, or local university, for instance, is now on the order of \$6,000, and in Peru there are now 700 *cabinas públicas* (public outlets, or kiosks) – a franchise operation serving local communities. If innovations like these continue, they may encourage Latin Americans to remain in the countryside – slowing or even reversing the rural-to-urban migratory trend.

Although various technologies offer promise for leap-frogging, technology alone is insufficient to propel the region forward in the information revolution. Human capital is critical. Latin America will need both trained, demanding users and technicians of all sorts to manage and repair networks. Some countries, such as Chile, are working to develop demanding users. In 1992, Catholic University in Chile began a five-year project to develop and evaluate an elementary school network called *Enlaces* (links). The project aimed to enhance efficiency, quality and equity in education and to "integrate the children into the culture." By the end of 2000, 100 percent of Chilean middle and high schools and 50 percent of grammar schools will have Internet-connected labs. *Enlaces* is

comprehensive in that it covers curriculum development and teacher training and collaboration as well as hardware and software. It was intended from the first to cover the entire nation, and, as such, different universities are responsible for different regions of the nation.

In addition to such elementary and secondary school projects, university networks throughout Latin America are graduating networking technicians, and the Organization of American States (OAS) provides some support in connecting networks. Despite these important efforts, however, the region still faces an uphill battle with respect to educational attainment. Only a handful of countries have adult literacy rates at or above 94 percent. As the opportunities afforded by information technology to the average person usually center around information gathering, literacy is an absolute prerequisite. In combination with the fact that only two percent of Websites were in Spanish in 1998, illiteracy is an important hurdle to be overcome in order for Latin America to successfully take advantage of the information revolution. To be sure, speech recognition and language processing is rapidly progressing, so literacy may become less of a problem.⁷ The question, though, is how rapidly those advancing technologies will diffuse to those less literate Latin Americans, most of them very poor, who need them.

Bottom Lines

The Internet did come late to Latin America, and, while it is still small relative to the rest of the world, it is growing rapidly. Numbers of end users and host computers are growing faster than the world average, but the gap between the region and the world's IT leaders is not likely to close. For the information revolution, as for roles in the global economy more generally, there is no "Latin America." Differences across the region are vast, and illustratively, the countries might be divided into three groups:

- the "leaders" – Mexico, Brazil, Argentina, Chile and Uruguay;
- the interesting, successful "outliers," like Costa Rica or some of the Caribbean islands; and

⁷ See Anderson and others (2000), p. xiii.

- the rest;

Variations across the region notwithstanding, its countries face many of the same problems in addressing the information revolution, and they seem unlikely to solve many of them by mimicking the approaches of the world's IT leaders. Outside major cities, the information revolution will not come to Latin America with hard wires and modems. It will come with new, wireless technologies, though those will hardly be a panacea.

3. The Economic and Business Dimension

Discussant: Timothy Heyman, Heyman y Asociados

Discussant: Ricardo Setti, iG International

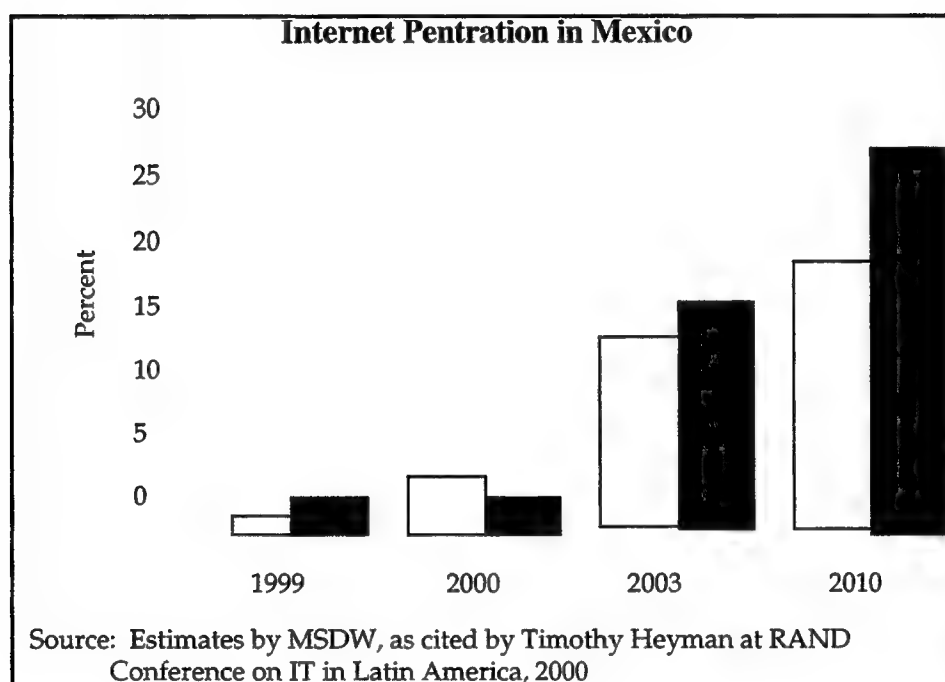
The Case of Mexico

The Internet appears poised to accelerate economic development in Mexico, but at the price of greater income disparities. Certainly, more broadly distributed gains would benefit Mexico -- a country of almost 100 million people and a GNP of about a half trillion dollars, or about a twentieth that of the United States. Its population is young, with seventy percent under 35 years of age, and the income distribution is skewed, with the top twenty percent accounting for 58 percent of income. As Table 3.1 shows, at present, the top 20 percent experience substantially higher penetration rates of various communications technologies than do Mexicans in general.

IT Penetration in Mexico by Access Device (% of population)		
	Total (%)	Richest 20% (%)
Fixed lines	11.5	33.4
Wireless	7.6	22.0
Total lines	19.1	55.5
PC	5.6	16.2
Internet (estimate)	1.6	4.6
TV	87.0	100.0
Cable TV	11.0	31.9
Source: Telmex, Goldman Sachs, and author, as presented by Timothy Heyman at RAND Conference on IT in Latin America, 2000		

Table 3.1: Internet Penetration by Access Device

As shown in Figure 3.1, current trends suggest exponential growth in Web access, from the current one percent penetration among homes and slightly higher penetration among businesses to approximately 18 percent among homes and 26 percent among businesses by 2010. This growth, however, is likely to be concentrated in the richest 20 percent of Mexicans.

**Figure 3.1 : Internet Penetration in Mexico**

The distribution of access to and benefits from the information revolution in Mexico is related to the industry structure, which can be divided into seven key categories:

- **Connectivity Providers:** Within Mexico there are multiple connectivity providers. Latin America connectivity providers operating in Mexico including Telmex and Telefónica, fixed line country operators such as Telmex/Telcel, Avantel (Worldcom), Alestra (ATT), and Bestel, and regional operators such as Iusacell (Verizon), Pegaso (Qualcomm), and Telefónica. New entrants to “last mile” access – that is, access to consumers – include

Unefon, Axtel, Metrored, and/or Megacable. Internet service providers include Prodigy (Telmex), Terra (Telefónica), AOL, and Psinet. At this time, satellite, cable and utility companies have no clear strategy for providing connectivity.

- Old Economy Incumbents: Not only the information technology companies are affected by the information revolution; all companies have an incentive to develop an Internet strategy, whether it is defensive or involves new businesses – and many companies such as Bimbo, Cemex, ICA, and Walmex have done so. While these traditional “bricks and mortar” companies face less risk of being displaced by new entrants – being “Amazon-ed” – than do their counterparts in the United States, some banks, media corporations, and telecommunications companies are more exposed to changes in the business environment brought about by the information revolution.
- Telmex: Teléfonos de Mexico, or Telmex, is the national telephone company of Mexico, and it looks like the clearest “winner” in Mexico’s IT sweepstakes. A connectivity provider, Telmex, which was privatized in 1990, stands out in almost every respect. First, it controls the “last mile” of wire to the consumers, controlling 99 percent of local telephones, and thus competitors are the position of having to get “let in.” Second, it has more flexibility than the incumbent telephone companies in other Latin American countries, which either had to develop their Internet strategies outside their corporate structure, or were prevented from becoming Internet service providers (ISPs), as in Brazil. In Mexico, Telmex currently controls 58 percent of all Internet accounts. Several Wall Street analysts believe that Telmex’s dominance is the biggest obstacle to the spread of the Internet in Mexico.

On the other hand, Telmex was the first to provide computer financing in Mexico. Telmex also differs from other Latin telecoms in that the company is owned largely by one man: Carlos Slim’s Grupo Corso, in conjunction with Southwestern Bell Corp. and France Telecom. Slim is Latin America’s wealthiest businessman, who also own Prodigy Inc., the third-largest Internet service provider in the U.S, and whose Grupo Sanborns recently bought CompUSA. Given its size – it accounts for a third of Mexico’s fledgling stock market – and its connections, it is hard to imagine strong regulation or other action against Telmex.

- Media: In the media sector, some companies are extending their information services. Televisa, the largest media company in Mexico with interests in television production, broadcasting, satellite services, publishing, and music recording, recently announced an Internet initiative. TV Azteca, a television programming company with a 30 percent market share, set up a cellular

service called Unefon and bought a substantial portion of Todito.com, which will allow it to distribute content on the Internet. One family owns all of TV Azteca, Unefon, Todito.com, the Elektra retail chain, Grupo DataFlux, and CNCI, a chain of 77 computer schools.

- Banks: As is the case with banks in general, the existing electronic infrastructure of banks in Mexico provides a foundation for e-commerce based on their established clearing systems. Foreign banks have made substantial inroads in Mexico in recent years; Spain's presence is particularly notable, with Grupo Financiero Santander Mexicano and Banco Bilbao Vizcaya Argentaria, S.A., topping the list. These, among other banks, are offering online banking and e-trading services, but unlike Brazil, banks are not offering Internet service in general. At present there are no "pure" Web-based banks or brokers, although a Patagon-Santander broker is leading a group planning such an institution.
- New Economy Start-ups: While there are few Internet start-ups in Mexico, there is a handful of companies, not really "Mexican," that provide services to Mexico and the surrounding region. Such start-ups are listed in Table 3.2 on the next page. The obstacles to start-ups are financing and lack of legal and other infrastructure. Given the need for scale, most Internet start-ups have to include several countries in a regional strategy, which makes set-up costs higher than in larger markets. Start-ups in Mexico have been financed mainly through international venture capitalists and established Mexican corporations, and only to a much lesser extent by local capital.
- Global Internet Companies: The final category of players in the information industry in Mexico are the global Internet companies such as Prodigy (Telmex), AOL, Yahoo, Terra, and PSINet. While these companies have a presence in Mexico, Latin America is not a priority for them. Other companies, like Amazon, serve Mexico without regional presence.

At present there are four primary revenue streams in information technology in Mexico --Internet connectivity, advertising, business-to-business (B2B) e-commerce, and business-to-consumer (B2C) e-commerce. In Internet connectivity, Infotel, owned by Spain's Terra Networks, is a distant second to Telmex, holding approximately 11 percent. Infotel, however, has recently introduced free Internet access. There are 44 other Internet service providers in Mexico, but the fact that they have, on average, fewer than 200,000 subscribers each suggests future consolidation.

Advertising on the Internet has yet to take-off in Mexico, although it does offer a new and unique way to reach the high-income population. There are only a few major online sites by new start-ups, and e-commerce is hampered, as everywhere

Table 3.2
New Economy Startups Covering Mexico

Company	Internet Segment	Coverage
EHola	Portal	Pan-Latin and U.S.
El Sitio	Portal	Pan-Latin & U.S.
Fiera	Commerce	Pan-Latin, U.S., and Brazil
IFX	Infrastructure and Portal	Pan-Latin
Patagon	Financial Services	Pan-Latin, soon Mexico and U.S.
Quepasa	Portal	U.S., soon Latin & U.S.
Star Media	Portal & Infrastructure	Pan-Latin & U.S.
Submarino	Commerce	Large Pan-Latin & Spain
Todito	Portal & Infrastructure	Mexico & U.S.
Zona Financiera	Financial services	Pan-Latin & U.S.

As cited in presentation by Timothy Heyman at RAND conference on IT in Latin America, November 1-2, 2000.

in Latin America, by how to pay and how to deliver. Mexico is relatively penetrated by credit cards, with some eight million, but there is nothing comparable to the U.S. sales tax advantage in buying online, and delivery is less trustworthy. Overall, B2B is more promising than B2C, and there are likely to be some first mover advantages. An important "pull" factor driving IT is the just-in-time inventory needs of the *maquiladoras*.

These obstacles to the development of IT and e-commerce in Mexico are familiar across the region. The power of Telmex is predominant, but the telecom incumbents are strong elsewhere as well. So, too, the absence of strong foreign and start-up competition is the case almost everywhere, as are the problems of how to pay for a deliver e-commerce purchases, and the limited experience consumers have with it. Mexico also suffers from slow and ineffective regulatory procedures, which in part reflect the importance of local interest groups.

A final question regarding IT in Mexico is also common to the region. That is the effect of illiteracy and low education levels on productively using, let alone

innovating in, IT. In particular, can Mexico overcome the growing "digital divide"? Like the railroads, recent IT is a reminder that growth can occur without development. Yet, there are some bright spots on the horizon. First, the incoming Fox administration brings opportunity for change and growth in telecommunications. Second, there are pockets of educational excellence such as the technological institute in Monterrey, which came up again and again in the discussions as a model. It has 27 branch campuses and an innovative virtual learning program. Third, NAFTA has brought significant growth to Mexico, although the disparity between it and the United States is enormous. Foreign direct investment in the country has grown from \$4 billion annually to \$13 billion since NAFTA. Finally, the existence of the Mexican diaspora in the United States, with access to information and resources, can also be viewed as an opportunity. While the digital divide is likely to remain a fact of life in most emerging markets, Mexico is one of the countries with the best chance of eliminating it.

The Case of Brazil

In Brazil, changing government policies facilitated the growth of the Internet. – beginning in 1996 when the government began privatizing the telecommunications sector. The country was divided into five IT regions, the most important of which was the city of São Paulo. Initially there was to be one company providing services in each region, with other companies allowed to enter and compete over time. In São Paulo, Telefónica, the Spanish company, began operating, and growth in telephones has been rapid. The city of 20 million had fewer than one million fixed phone lines in 1996; and on the open market a line cost \$1,000. Now, there are five million lines, and the "free market" for lines has disappeared. .

The lack of appropriate infrastructure means that interior areas of Brazil have not fared as well as São Paulo with respect to hard-line penetration, but cellular technology has increased rapidly in those areas. The privatization of the cellular industry in 1997 contributed to that growth. Until then, mobile cellular remained a monopoly in the hands of the national telecommunications giant, Telebras, plus four independent companies with local monopolies. In 1997, companies were permitted to bid for ten regional cellular licenses. Today cellular phones allow millions of Brazilians access to information technology.

Because only one tenth of economically active Brazilians have bank accounts, paying for information technology services is a challenge. In the case of cellular technology, 65 percent of users take advantage of prepaid services. It is no

surprise, then, that the introduction of free Internet services sharply increased the number of users. Free Internet access arrived in Brazil in 1999, when Universo Online (UOL), in existence since 1996, and Internet Gratuita (iG) became free. Other providers soon followed. Before it offered free access, UOL had 5 to 6 million visits a day; now the number is on the order of 30 million. Unfortunately, because these free ISPs rely on advertising to cover costs, the recent economic downturn has forced many providers to close shop. Those that have survived had partners, or were banks that offered free Internet banking to secure accounts. iG changed its name from "Internet Gratuita" to "Internet Grupo," and no longer provides all services for free. UOL, the biggest ISP in Brazil, has yet to turn a profit after four years; its loss last quarter was \$40 million.

By law, telecoms in Brazil cannot be ISPs. They can and do invest in ISPs, but those investments are also limited. Non-Brazilian companies that sought to enter the ISP market on a regional basis have found it difficult to do so, in part because Brazilians think of themselves as apart from Spanish-speaking "Latin Americans."

E-commerce in Brazil is in its early stages. As of yet, big retailers have not developed serious Internet strategies. One obstacle to the growth of e-commerce is the limited use of credit cards. At present, only 3 to 4 percent of Brazilians have credit cards – making online payment difficult. Banks are reluctant to open accounts for individuals earning less than \$200 per month. Another obstacle is a weak infrastructure for distribution and delivery of goods. Such obstacles may require e-commerce producers to develop payment, distribution, and delivery strategies different from those currently in use in the United States and elsewhere. One such strategy has been the development of prepaid "smart cards," which are already used to pay for other types of goods and services.

While Brazil's IT industry is not as developed as the United States, Canada, or western Europe, it probably has more indigenous IT technology than many other countries in the region, perhaps in part because Brazil tried so long to remain closed and develop its own technologies. Despite this advantage, the country still faces challenges in training technologists. While good programs exist, such as those at the universities of São Paulo or Campinas, they are limited in output, and some of them are expensive.

Bottom Lines

The case of the Internet today is intriguingly parallel to railroad building in the last century: Both held promise of dramatic increases in national wealth but at the price of growing disparities across citizens. In 1845, investments in railroads, like the initial public offerings (IPOs) of high-flying technology companies in recent years, equaled the GNP of Britain. Commentators talked of "railway time" and the "death of distance." Yet by 1853 the bubble burst, and the value of railroad stocks had declined by 85 percent. Competing railroads were building duplicate tracks. Later in the nineteenth century, railroad building in Mexico accounted for half of total economic growth. Then, as now with talk of the "digital divide," the growing disparities of wealth that result from railroad building was cause for concern; owned by foreigners or local oligarchs, railroad building generated growth but increased income disparities. In Mexico, the backlash against this social impact of the railroads contributed to the Revolution of 1910. Mexico has built not a single kilometer of railroad track since.

Will the Web fall prey to the same fate as railroad building, with bright promise ending in dashed hopes, even a backlash? There is a decent case that it need not do so. Both Mexico and Brazil are markets too big to ignore, and both have some "points of light" – UNAM, Monterrey Tech and Silicon Valle in Mexico, the university-based incubators and some venture capital in Brazil. Mexico also has its special connections to the United States – the "pull" of the *maquiladoras*, and the intermediary role of Mexicans living in the United States. Both, however, are hampered by corruption and by the vestiges of statist policies, for instance nationalized industries, complicated tax structures or, in Mexico, the requirement of majority domestic ownership.

4. Information Revolutionaries

Keynote: Ernest Wilson, University of Maryland⁸

Is Latin America's IT glass half full or half empty? Globally, IT is developing fast in the poorer countries, at 18 percent yearly, but it is growing faster in the rich countries, at 23 percent.⁹ The result is that the gap between "haves" and "have-nots" is growing. In consequence, Africa, Latin America, and much of Asia are sometimes viewed as emerging market opportunities and sometimes, more cynically, as regions that are too far behind to be priorities. "Information revolutionaries," or the lack thereof, are important shapers of countries' IT futures.

Why are they important? Why should we care about *who* is making the information revolution? There are four compelling reasons why. First, we should seek best practices in the information revolution – and find out what works and what doesn't. Second, examining information revolutionaries is another way to identify and examine patterns that emerge across nations. Third, a critical look at the IT players is an examination of leadership, which seems especially important during periods of great institutional change. The information revolution is, in fact, only half about technology. It is also about institutional and organizational arrangements, and so the character of relations among the government, the non-governmental organizations (NGOs), the telecoms, and the ISPs are key.

Looking at the information revolutionaries lets us better understand the unique roles as well as the interconnections of the private sector, the public sector, and civil society. Who are the local allies, local partners, local competitors, suppliers, customers – and who is leading these groups? Who are the leaders in the government, and what role do they envision the government playing in investment and regulation? Who are the leaders in civil society? This is an especially important question for poorer countries, including in Latin America, because NGOs can spur both public and private sectors into action.

⁸ See his forthcoming book, *The Information Revolution in Developing Countries*, (Cambridge, MA: MIT Press, 2001).

⁹ Cited in Wilson and Francisco Rodriguez, "Are the Poor Losing the Information Revolution", available at www.bsos.umd.edu/cidcm/wilson. The numbers are indices reflecting a basket of IT applications, such as Internet hosts, faxes, TVs, and cell phones.

A study of the "revolutionaries" across a number of developing countries found them to be mostly males, with degrees in technical fields, neither poor nor rich but upper middle class, most of whom attended graduate school in the United States. They returned home not to make money but to make a difference for "their people." One such Chinese, for instance, observed that his country had missed the industrial revolution, and he wanted to do what he could to assure that it didn't miss the information revolution. The revolutionaries spread across the public, private, and not-for-profit sectors, with a small handful highly placed in government. In Morocco, the core group consisted of two people at a polytechnic institute, one person in the private sector, a handful of others in NGOs, plus one who had the ear of the Prime Minister. How do they do what they do? They appear to blend technical savvy and social skill, making use of pre-existing personal networks. The personal networks appear to precede technical networks, and to contribute to the development and diffusion of the latter.

As they are distributed throughout government and industry, different people play different roles. One role is *promotional*, attending meetings and promoting technology. A second role has to do with the *development of legal structures* that are necessary if IT is to grow, including the protection of intellectual property rights. A third role is *leadership* to build a national constituency, one that is invested in the growth of information technology. Finally, there are those who *promote structural and institutional changes* in order to forward IT growth. Perhaps the role of *entrepreneur*, actually linking capital, technology and a business model, is a fifth one. It would be interesting, though it remains to be proven, if the revolutionaries turned out also be to carriers of ideas such as transparency, accountability and democracy because they realized that institutions had to change in order to take advantage of new technology.

Information revolutionaries appear and play different roles at different stages in the development of a country's IT. The case of Brazil illustrates four phases. The first phase might be called *pre-commercial*, during which most changes took place in research and university institutions. In Brazil this activity centered on the National Research Council. The second phase was a *commercial* period in which ISPs were developed and individuals got online. In Brazil this period began in June 1992 with the creation of the first ISP. By 1995 about 45,000 Brazilians were online.

A standoffish attitude by Brazilian information revolutionaries toward the government in the first period was reflected in the second. The revolutionaries had sought and succeeded in banning telecom ownership of ISPs not because they disliked Telebras per se but rather because the government owned it. They

wanted to move fast, and they regarded the government as slow and so sought to keep it out of the Web. During this period, a consortium of Brazilian newspapers joined to form UOL. The third period, extending from approximately 1996 to 1998, can be deemed the *competitive* period, when privatization was occurring and "property rights" were in doubt. The fourth and final phase might be called *consolidation*, but Brazil has not reached that stage and so what it will entail remains unclear.

Bottom Lines

The interaction of the university-based national research community, the government, and the private sector, both national and multinational, is critical. The United States reached its leading position in IT through several phases. In the first, the government led the way in early research and development, virtually all of it sponsored by the military. More recently, the government has mostly gotten out of the way, letting private sector innovation and competition drive new business models. That latter process features, in Joseph Schumpeter's words, much "creative destruction." In contrast, many Europeans would prefer a more predictable, more controlled, government-led process.

Where does Latin America stand? Might Latin American governments again enact high barriers to make sure that foreign companies don't overwhelm the domestic companies as they did in the 1970s? Will information entrepreneurs in the region want governments to stay out of the way or protect them? The answers to these questions are directly related to assumptions about the role of IT in development more generally. If it is believed that growth ensues because countries *make* IT products, then it is tempting to protect infant IT industries from foreign competition and to rely on them to substitute for exports. Instead, if growth comes from *using* IT, then import substitution is inappropriate, and the country should seek the best technology at the lowest price, whatever the source. Now, there is some renewed interest in the region in import substitution, driven by the frustrations of a generation of export-oriented policies that produced growth but very uneven growth, both within countries and across the region. The interest may also be driven by the worry that the region cannot hope to keep up, let alone catch up, in a global IT competition.

5. Small Group Discussion: Economic and Business Dimension

Facilitator: Robert Anderson, RAND

Facilitator: Tora Bikson, RAND

Facilitator: Ernest Wilson, University of Maryland

Each of three breakout groups reflected a sub-region: the southern cone, including Brazil; northern South America; and the Caribbean, Central America and Mexico. Each group was asked to address three questions for its sub-region: 1) How does the economic and business dimension of the information revolution vary? 2) What drives these differences? and 3) Are there issues or problems that are common across the sub-region?

Group 1: Southern South America

Southern South America, with the exception of Paraguay, is ahead of the rest of Latin America in existing infrastructure and business environment. However, to better understand sub-regional variation, the countries were evaluated along eight dimensions:

1. The competitiveness of the telecommunications market;
2. Whether or not government enables the growth of information technology;
3. The state of venture capital;
4. Availability of personal credit to pay for IT-related transactions;
5. IT-issues related to language;
6. The education system;
7. Intellectual property rights; and
8. Market size;

Within the sub-region (Brazil, Uruguay, Argentina, Chile, and Paraguay), Chile has the most competitive telecommunications market, followed by Uruguay, Brazil, Argentina, then Paraguay. Uruguay was ranked relatively high despite

the presence of a state-owned monopoly because that monopoly “works,” and there is competition in providing value-added services. Taxes are a major issue for Brazil, whose tax structure is too complex with too many taxing authorities. Not surprisingly, some companies are leaving Brazil to seek better tax environments elsewhere. Because only two telephone providers operated in the country until 1999 (Telefónica de Argentina and Telecom Argentina), Argentina was not considered particularly competitive, although opening all areas of telecommunications to an unlimited number of licensees in November 2000 was clearly a step in the right direction. Paraguay’s telecommunications infrastructure and industry are far and away the least competitive of the group.

The most important role government can play is to make possible telecom reform. The ranking of countries along this dimension mirrored that of the previous category, with Chile again highest. The overriding concern in the remaining countries is corruption, which undermines government effectiveness and authority. At present, there is more trust in local and regional governments in Brazil than in the national government. Similarly, trust in government in Argentina is quite low, although better-educated people do believe government can make a positive impact on the development of information technologies.

None of the countries has in place laws and regulatory structures to permit venture capital to flourish, but those regimes are developing. That said, good telecommunications policies and a competitive economy are not enough to attract venture capital. The case in point is Chile, which is not attracting large amounts of venture capital despite its high marks on the previous two dimensions. In part, the country has a history of controls on foreign investment, which have only recently been lifted. By contrast, despite Brazil’s less-than-perfectly-competitive economy, complicated taxes and level of corruption in government, it is a big enough market to be able to attract more venture capital than Chile. While having access to foreign capital is valuable, relying too heavily on foreign investment means that profits flow out of the country. What is needed (in addition to foreign investment) is indigenous venture capital, as appears to be developing in Brazil and Argentina.

Again, the problems entailed by the low levels of credit card use in the region were cited. Countries have to find innovative ways to extend services to individuals who would otherwise not have the ability to pay. Brazil has been a leader in getting around the shortage of credit cards with innovations such as smart debit cards. In Argentina, people can now pay cash for Internet services in places where they would normally pay utility bills.

The region's lack of English competence poses a short-term problem because only two percent of all Web content is currently in Spanish. Only individuals of a certain level of education are able to access and understand the majority of information online. However, since virtually everyone in the region can understand Spanish, and the number of Spanish-language Web sites has been increasing, language issues are unlikely to pose a problem for the region in the long run.

A particular challenge for both southern South America and all of Latin America is education. Although countries of the Southern Cone do have higher levels of educational attainment than Latin America overall, primary and secondary education is still deficient. Local educational systems produce quality in some places but not in large enough numbers to accommodate the needs of the new economy. Argentina, Uruguay, and Chile are regarded as better than Brazil. Yet regional discretion in Brazil, coupled with IT, gives its regions the flexibility to break away from the traditionally centrally controlled education system, and to experiment with forms of distance learning and computer-aided instruction. . Uruguay has an educated workforce, and as a result has a growing indigenous software industry. Paraguay's educational system is particularly poor.

Finally, in terms of protecting intellectual property rights (IPR), Chile also ranked better than other Southern Cone countries – and Paraguay fell to the bottom. IPR was considered a problem for the whole region, however, because of shortcomings in enforcement.

Looking out ten years, Chile would most likely be notable for embracing the information revolution, while Brazil will stand out in sheer market size. Argentina and Brazil appear to be moving in the "right" direction, although questions remain. In terms of its economic standing and progress in the information revolution, Mexico could be considered part of this leading group, while Paraguay should not.

Group 2: Northern South America

This region of Latin America suffers from political and economic instability that has encouraged a "brain drain," which stifles not only the development of IT but also economic development in general. Would getting good information systems in place be the stabilizing force that this region needs? Absent a crisis or other focusing event, IT seems likely to be neither stabilizing nor destabilizing in the region. In the short run, the Internet may increase the social gap both between and within countries. It will have a different impact on urban and on rural

communities. For instance, will the development of the Internet encourage people in rural areas to stay there? Absent a real change in the circumstances of farming, being connected might simply make it easier for them to leave.

Perhaps, over a longer time horizon IT could build stability. If better information systems permitted middle class voices to be heard, that might empower the middle class in ways that would not necessarily lead to greater political stability in the short run but would lay the basis for more transparent and accountable government in the longer run.

At this point, however, such a prospect is not likely because there are few resources; advertisers are not willing to support media that oppose ruling government elites. Still, a recent case is suggestive of the possibilities. When Venezuela's president, Hugo Chavez, made a deal with Cuba's Fidel Castro, many of the deal's provisions – like bartering Venezuelan goods for Cuban doctor and other professional services – were questionable in the norms of international trade. Details of the deal were suppressed from traditional Venezuelan media, but those details did leak out via the Web. As governments learn about the potential dangers of the Internet (to them), they may attempt to move against it in various ways, but they will also face sharp limits on how much they can control information flows.

Group 3: The Caribbean, Central America and Mexico

This third group is unique because of its "outliers." Some of the mostly small island states in the Caribbean have per capita incomes that are among the highest in Latin America and are much further along in IT penetration and use. These include the Cayman Islands, the Bahamas, St. Barts, Aruba, the British Virgin Islands, and the U.S. Virgin Islands. These outliers share several preconditions: their governments are founded on trust and transparency; they have a well-established rule of law, high literacy rates, economic cultures in which business can prosper, populations that are fluent in English, and, perhaps most importantly, political stability. It should be noted, however, that these countries' IT advances were driven by the needs of their commerce – tourism and banking, including, unfortunately, money laundering – not the other way around. The existing electronic infrastructure associated with these industries made it easier for them to incorporate new information technologies.

In Central America, Costa Rica is the outlier. Intel has based an assembly plant there, which has had a major impact on Costa Rican employment and growth. In attracting Intel, Costa Rica took politically risky steps, such as committing to teach English in primary schools. But Costa Rica had advantages similar to the Caribbean islands – a good rule of law; a population that mostly has a “working” knowledge of English; a program to wire every school in the country, so that much of the younger population will soon become computer and Internet savvy; and a sizable number of trained engineers available to work in and IT plant or in supporting industries. Moreover, Costa Rica has a business school, INCAE, founded with help from the Harvard Business School. Costa Rica has, in effect, created an IT *maquiladora*. In addition to Costa Rica, other bright spots in Central America are: El Salvador, which has a great deal of entrepreneurship; and Panama, which is aided by its dollarized economy and by the considerable American influence.

Mexico, in many ways more akin to the southern South America countries with respect to IT, faces both good and bad prospects with respect to the information revolution. On the positive side, the existence of NAFTA and the proximity of the Mexicans living in the United States make it easier for Mexico to access information, human capital, financing, and technology than other countries in the region. The transition to the new presidential administration appears to be going smoothly, and the new president has articulated a desire to move the information revolution forward in Mexico. Human capital exists at the Monterrey Technical Institute, the “Mexican MIT,” which produces large numbers of trained engineers and information scientists and in “Silicon Valle,” a region of Mexico in which IT start-ups are beginning to thrive. On the other hand, Mexico faces challenges of corruption, large income disparities, and rapid population growth – which stretch local economies and the educational system. In addition to these challenges, the 51 percent domestic ownership requirement for all companies and the major role that nationalized industry plays in the economy are big obstacles to IT development in Mexico.

Bottom Lines

The differences across the region – in particular, among the leaders, the outliers and the rest – are stunning. If the leaders share many obstacles, they also have some differing advantages: Brazil is a large market, Mexico has its connections to the United States, Chile is the most competitive telecom market, Argentina has recently opened up, and Uruguay has a state-owned telecom monopoly but one that works pretty efficiently. The outliers illustrate the “pull” of using IT to become more efficient in existing industries, just as the *maquiladoras* do in

Mexico. Those outliers also shared a number of preconditions – transparent governance, relatively low levels of corruption, rule of law, favorable business climates, decent to good levels of English among the population, and the presence of trained technical people. Those are the preconditions for moving forward with IT, and they are also preconditions for economic growth more generally.

It is hard to be optimistic about the rest, especially northern South America, where violence is growing, the lure of populist politics is present, and the brain drain is a fact of life. Those talented people who can leave, do leave, often for Miami, the magnet that has attracted the greatest amount of Latin American talent, and is an, if not *the*, IT capital of Latin America. Miami is much more than the Cuban community. While there are limits to Miami's potential to unite Latin America around information technology or other issues, Miami still has advantages that are not present within the region.. Its attraction underscores that even where the region should have an advantage – for instance in producing content, not just for the region but for Spanish-speakers elsewhere – it faces competition, from Miami but also from Los Angeles and other U.S. cities that combine technological prowess with large Spanish-speaking populations.

6. The Political Dimension

Discussant: Diego Arria, Technology Holdings International

Discussant: Antonio Botelho, Universidade Católica do Rio de Janeiro

Discussant: Elliot Maxwell, U.S. Department of Commerce

Discussant: Robert Vitro, InterAmerican Development Bank

The information revolution touches all of society, and so the different dimensions cannot really be separated. For instance, the role of government is eminently political but also is critical to the business environment. Or a social dimension, like education, also is at the heart of countries' economic and business opportunities in information technology. This section begins with a framework for thinking about government policy, then turns to Brazil and to a perspective from Venezuela on the region.

The Role of Government Policy

It is striking that leadership by the private sector is widely accepted yet the role of government is important. There are a number of ways to consider the role of government policy in the information revolution. In the United States, the "creative destruction" model assumes that the private sector should lead, and that governments should mostly stay out of the way, of e-commerce, for instance. Yet government is needed, most obviously in sustaining a legal framework for commerce. That framework should be predictable, minimal, consistent, and simple. Governments need to recognize the unique qualities of the Internet, as well as the fact that e-commerce must be treated on a global basis.

As part of a legal framework for the Internet, developing a system for managing electronic contracts is clearly a role for governments because enforcement ends up in the public courts. Specific issues in this area include digital signatures, jurisdiction and dispute resolution, taxation, electronic payments, and antitrust. In the area of digital signatures, the U.S. government has been arguing that governments should be technologically neutral and should not certify digital signatures, but should instead let the market do so. Yet whether or not the market can accomplish this task is debatable, and many Latin American countries currently are considering electronic signature laws.

At present, there is no one place to resolve international disputes over e-commerce. When a business is located in multiple places, with distribution and delivery around the world, it is unclear whose laws should apply. Producers and consumers both will want jurisdiction where they have most confidence they will be treated fairly, better yet favorably, and usually that will be their "home" country. At present, the U.S. government argues that mechanisms for resolving disputes online will minimize arguments over jurisdiction and keep disputes out of courts.

A related and obvious challenge for government is taxation. In European (and some Latin American) countries, value-added taxes apply regardless of where goods are sold, while in the United States taxes on sales are mostly at the local and state, not federal level. Coordination of these systems is a logistic and legal challenge. The Europeans now talk of "coregulation," though the meaning is not yet clear. The goal will not be global rules but rather "interoperability," which would permit somewhat different rule regimes to work together. Electronic payments also involve governments, and some Latin American governments have passed laws to govern such payments. Antitrust issues arise as well, from concerns that e-commerce will create "winner take all" possibilities.

Governments have a role in building confidence and trust among consumers. This role includes but extends beyond privacy and authentication to take in consumer protection, cybersecurity, and intellectual property protection. These issues are complex, as a recent case in France illustrates. French courts wanted yahoo.com, in the United States, to be held accountable for content placed on yahoo's subsidiary site in France. The recent controversy over the 38-million napster.com subscribers illustrates the challenges of intellectual property rights, especially when companies seek to patent business lines or processes. So, too, cybercrime is difficult to prosecute if, as in the case of the "love bug" in the Philippines, the act committed is not a crime where it was committed. On the other hand, strong encryption is now a fact of life; U.S. companies can export it to anyone except states on the U.S. government's terrorist list. .

Governments also help build a country's information infrastructure, by establishing a framework for competition in communications, setting policies on spectrum, working to open markets abroad, fostering interoperability, and managing domain names. Governments can also work to foster digital inclusion along dimensions of race, gender, income, geography, age, and physical disabilities, to narrow the international digital divide, and to reach out to small and medium size enterprises. There is also a need to measure the state and progress of the digital economy, a role that also seems a natural one for government.

Last, but certainly not least, is e-government itself. As has been noted previously, some governments in Latin America, such as Brazil, have made progress in collecting taxes online. Since governments are relatively important in Latin America, the effect as they move online – to collect taxes, file trademarks and deliver services – will be correspondingly significant.

The Case of Brazil

At the root of the politics of the information revolution in Brazil is hostility between the telecoms and those who are making the information revolution. These two groups do not communicate with each other, have different histories, and have different bases of support. Despite this friction, growth and innovation are evident. Sixty percent of Brazilian tax returns are filed online (the figure would be more impressive except that perhaps two-fifths of the total economy is "informal," hence completely untaxed). Brazilians recently were able to vote electronically. The telecom regulatory regime is now solid, after Brazil learned from the experiences of Mexico and Argentina. There are now 22 million cell phones in Brazil, a number expected to grow to 58 million by 2005. E-commerce in Brazil, at \$300 million in 2000, is the biggest market in Latin America.

There are now 7 to 8 million Internet users, and the government, which has just published a "green book" or discussion document on the information society, hopes that number will increase to 37 million, or a fifth of the population, by 2005.¹⁰ The government is trying to wire its 26,000 schools and 6,000 libraries, along with other centers, or "telekiosks." Now, fewer than four percent of elementary schools are wired. A government fund takes two percent of gross telecom revenues, and new initiatives compete for this funding – for instance, to create kiosks in *favelas* (slums), or to link the cities in Pernambuco State, or Parana, or Rio. Rio Digital aims to let *favela* dwellers band together to buy groceries or construction supplies in bulk and have them delivered to the *favela* entrance, from there to be distributed.

Venture capital and incubators are increasing. One model is somewhat akin to Japan's *keiretsu*, i.e., groups of industrial firms organized around a bank and closely coordinating their strategies and their purchases. This arrangement would let existing firms share risks. It may run afoul of antitrust regulation, however, suggesting that some changes in antitrust policy may rise on the agenda. Pension funds are another source of funding, but with interest rates at 30 percent there is little incentive to invest in anything other than short-term

¹⁰ See www.mct.gov.br, Livro Verde Sociedade da Informação.

paper. By the same token, only the national development bank now confers "microcredits," which are in any case likely to be too small to finance IT ventures, though they surely could help other businesses become better users of IT.

Throughout Latin America, cell phones will be key, and, as in other dimensions of the IT revolution, Latin American applications may be different. For now, cell phones in fixed kiosks can supply simple information. But third generation cell phones, on which Europe has placed an enormous bet, will be very large (3 megabits/second) pipes. Can that link become a viable business? There are still a lot of places where it is hard to get a cell phone, and so Latin America's solutions will have to be different than Europe's.

A Venezuelan Perspective on the Region

NGOs have pushed the social dimension of IT development, and the organization of NGOs has in turn been promoted by IT. Yet one of the focal points for the organizing of NGOs has been Mercosur, the regional free-trade initiative, and most of the NGOs that have emerged are against Mercosur. For their part, most Latin American governments have opposed NGOs as a challenge to their power. They want trade and commerce but not political integration or freer movement of people. They see the Internet as an instrument of power. Consider tax structures on IT, which give advantage not to the people or to IT development but rather to government budgets: computers in Venezuela are twice as expensive as those in the United States, entirely as a result of taxes. Many leaders give lip service to the empowerment of NGOs but in fact fear the phenomenon.

There is no Spanish counterpart to the word "accountability," but IT can be a boon to accountability in the region. As in the Chavez-Castro case, it could make available more information. The issue of cybersecurity in Latin America exists in this context. Security surely is a problem, from both hackers and the determined underworld of IT, terrorists and criminals. If the infrastructure for deploying IT in the region is fragile, might security become such a worry that governments and business shun new IT technology and resort to "old economy" ways of doing business -- face to face meetings, paper memorandums and phone calls? In fact, when governments are determined, as in Brazil's online elections, they can manage security. At this point, security is probably more an excuse for not moving toward more accountability than it is a real stumbling block.

Bottom Lines

It is striking that, while there is a debate about the role of government in IT, that debate presumes that the private sector will be the leading edge. Government plainly has roles to play in establishing legal frameworks, adjudicating disputes, building public confidence and developing the infrastructure for IT. *Where* to adjudicate disputes is itself an issue, as consumers will want adjudication in "their" country, suppliers in theirs.

Governments remain large in Latin America, and thus they will also be important users of IT: witness those Brazilians who vote or file tax returns online. Yet, on the whole, the region's governments have taken a "fiscal," rather than a "consumer," approach to IT; they have kept prices high for tax reasons – and so computers costs twice as much in Venezuela as in the United States. Governments pay lip service to IT as a means of increasing the transparency of governance, but most of them pay little more than that. And advertisers are not willing, in many countries, to support media that oppose ruling governments. As governments learn about the potential dangers of the Internet to their power, they may move against it, but the Chavez case suggests the limits they will confront in trying to control information flows.

7. The Societal Dimension

Discussant: Juan Enriquez, Harvard University¹¹

Discussant: Susan Kaufman Purcell, Council of the Americas

This session posed sharply the question that had been running through the workshop: can Latin America hope to compete in the information revolution? What, though, does "competing" mean when, for most countries, the premium will not be on creating information technology or artifacts but on using IT to become more efficient across the board? Given that, what will it take for the region to compete? And what choices, if any, will it have?

Can Latin America Make Its Information Revolution?

This discussant's argument posed that question sharply, and its answer was mostly "no." The argument focussed on the centrality of information and knowledge, by a broad definition. As noted by the discussant, it is often observed that the structure of global production is changing. Manufacturing is less important and services much more so. But the high impact "services" are not about serving hamburgers; they are about creating and manipulating information. What distinguishes successful societies from ones that are not, in this argument, is the ability to use information.

The discussant noted that commodity prices, in real terms, are now about a fifth what they were in 1845; not so long ago, agriculture was a third of the global economy. Last year, Silicon Valley generated as much economic value as all of India; chips are more valuable than steel. Nations seldom covet their neighbors' land; Iraq did want Kuwait's oil revenues, but there was never a hint in 1991 that the United States might "keep Kuwait." Both the United States and Brazil got bigger after their independence, but there is no need to be big today. As UN members have gone from 50 in 1946 to 184 in 1994, there is a whole lot of land in the world that nobody wants. The commodity of choice is not land. Indeed, agriculture is a drain for Europe, which spends half the European Union budget on agriculture, a sector that accounts for less than 5 percent of GDP.

¹¹ See Enriquez (2000) and a forthcoming book, Enriquez (2001).

Agriculture is a small margin business, but the United States is changing that with genetically modified organisms (GMOs); those can raise the margin to perhaps 6 percent. NGOs and others in Europe oppose GMOs, and while Monsanto may "lose the company" in the short run bet on GMOs, in the long run the power of GMOs not just to increase food margins, but to battle cancer and other diseases, will prevail. Meanwhile, when Europe's Novartis was hectorred out of GMOs, all its scientists went straight to the United States. The commodity of choice is information.

According to this argument, the key to both using and producing information technology is developing human capital. But most Latin Americans are not nurturing their intellectual talent. In Mexico, for instance, when a small group of committed activists were permitted to close down the premier university, UNAM (Universidad Nacional Autónoma de México, or Autonomous National University of Mexico), for more than a year over issues nobody could quite articulate, that decimated what had been a promising molecular biology department. The average Mexican salary is only 27 percent of what it was in 1976, and the value added in Mexico of Mexican *maquiladora* exports amounts to only three percent of the selling price.¹² Unwise government policies are most of the reason, but to sharpen the caricature, according to this argument, a part is that Mexico is not creating knowledge. It is making fewer patents now than it did in earlier years. Those who register patents in Mexico are multinational corporations.

Or, take flowers as another example. According to the discussant, there are many places in the world that would seem ideal for flower growing, but the leading country, Holland, is not one of them. What does it have? Not soil or weather, but rather what was argued to be "knowledge" by a broad definition -- the know-how to build functioning airports, good agronomists, and sophisticated financial systems that will lend against tulip bulbs. Similarly, why is it that Mexico's product, cacao for chocolate, is now exploited most profitably by Switzerland? The answer, according to the discussant, is value added through knowledge -- in this case, superior business models.

IT and Social Services

In the context of a global knowledge economy, one of the primary obstacles to narrowing the income gap in Latin America is education, which is, again, an

¹² The figure for Mexican wages is for 1996-1997. See Mexico (1998), pp. 402, 403, 407. Manufacturing wages did not suffer the same decline.

enormous problem in the region: Drop-out rates are high, repeat rates in primary school are very high, teaching materials are outdated, and the worst teachers are in the primary schools. At the university level, teachers are ill paid, and as a result moonlighting and part-time teaching are the norm. Unions and bureaucracy hamper performance, and the upper classes send their children to private schools. Can information technology help to improve this situation? Some experiments with virtual universities, like ITESM in Monterrey or the university in Bogotá, are promising. Online education programs are likely to be especially helpful to individuals otherwise unlikely to enroll or continue in formal schooling. It will be intriguing to see how much difference IT makes in primary and secondary school, as well as in post-secondary and continuing education.¹³

There are other areas in which IT could improve service delivery. In health, for instance, IT can provide information first, then enrollment and payment, and ultimately it could make possible distant interactions with health providers. Perhaps IT can spur the growth of smaller cities, which might be magnets for the rural poor even as the same technology permitted the wealthier to move back into the countryside without sacrificing the comforts to which they were accustomed.

An upside for Latin America is that it has a young population, with more than half the population under 30 years of age. Those young people look at the industrial world, and they want to join it. In addition, an opportunity for innovation is present: recall that "made in Japan" was a U.S. description for shoddiness in the 1960s but the complete opposite by the 1980s. The outlier cases are worth pausing over. Singapore, for instance, was deeply worried about its future as an independent city-state, and it courted Hewlett Packard; what Costa Rica did with Intel was similar. Bangalore had the advantages of English and of good education, and now almost half the H1B visas that the United States issues for skilled technicians go to Indians. Not just Silicon Valley, but all of U.S. high tech, could hardly function without Indian systems engineers and programmers. That may be "brain drain" in the short run, but those Indians, like the Latin Americans working in Miami, represent a potential resource for their countries.

On the down side, Latin America produces more lawyers than technologists, though that could change. The region is divided internally, in many ways, including "digitally." In terms of models, its political culture and business-government relations are more like Europe's than the United States'. That

¹³ This issue was addressed in Anderson and others (2000), pp. 43-4, 68-70.

European model has made the government the leading edge of the economy, with considerable central planning despite recent waves of privatization, and with upwards of two fifths of GNP passing through government hands in some countries. New technology, though, is beginning to break down the culture of looking to the government to solve problems, and Mexico and Argentina seem most convergent with American models. Latin America will divide physically as well, as southern Brazil or northern Mexico acquires an identity of its own. It has suffered recently from reversions to the "bad old days" of populist policy, as in Venezuela. So long as the poor lack a stake in society, Latin America will be vulnerable to this kind of demagoguery. Better information could indeed increase accountability, making for less tolerance of bad policy, at least outside the Andean countries.

Bottom Lines

Despite the importance of information technology, Latin America is behind in the game, and the game is not just IT, but rather it is economic development more generally. It is not investing enough in the human capital, and it is not achieving the economic and political stability needed to lure back talented Latin Americans from abroad. Neither is it developing indigenous IT or other knowledge-based industries, nor is it rapidly incorporating IT to make existing industries more competitive in the global economy. In recent years, Latin America has seen absolute incomes rise but so have the income disparities. Only 1.5 percent of Latin Americans has access to the Web today, versus 24 percent of North Americans. Web penetration will still be less than 12 percent by 2005, and most of those will be in the richest 20 percent of Latin Americans, about 100 million people in total. That fact will be a disadvantage for the region. *Latin America did not close economic and social gaps during the industrial revolution, and it is unlikely to do so during the information revolution.*

8. Small Group Discussion: Political and Societal Dimensions

Facilitator: Robert Anderson, RAND

Facilitator: Tora Bikson, RAND

Unlike the first breakout session, these two groups were not asked to look at sub-regions but across the region as a whole. The groups took different approaches in looking at these issues, focusing on leading countries and human capital, respectively..

Focusing on the "Leaders"

The first group examined the connection between social factors and the IT revolution, focussing on the "leaders" – southern South America plus Mexico.

The first question raised was the role of women. Are they a large untapped resource? Perhaps not just women but many parts of society are not being fully tapped. With widespread under-investment in human capital and entire segments of society completely outside the formal economy, issues related to women specifically seem secondary. However, the "newness" of the information technology industry could be an opportunity for women to break out of traditional roles. In fact, every large Brazilian IT company has women in senior positions.

Issues associated with human capital development lead logically to issues of higher education in general. One issue is testing. For all the U.S. debate over the cultural bias or fairness of testing, many Latin American countries suffer from the lack of the evaluation those tests provide. Standardized testing is not common in Latin America. While Brazil is establishing an SAT-like test to replace the national entrance exam for universities, currently Brazilian universities get a university-wide grade (an accreditation mechanism) based on exam scores of the students. Employers are allowed know the university grade, but not the individual's grades. This contrasts sharply to other places in the world, such as Silicon Valley, where immigrant Indian technicians still remember and compare their grades from standardized tests at home.

Because companies often look to locate near universities with the right human capital, it is logical to ask: Which countries have the university structure with the

right people to attract existing companies and start-ups? Mexico is noted for UNAM, as well as the Monterrey Technical Institute. Brazil stands out for its university-related incubator programs and growing indigenous venture capital market, while Chile has its secondary school *Enlaces* program that will eventually introduce more IT-interested students into the already successful higher education system. While some biological sciences and agriculture programs in Argentina and Uruguay are impressive, their connection to IT is indirect at best.

Even with successful programs at national universities, often the most talented students in Latin America leave the region to complete their higher education. Many are educated abroad and as a result stay abroad to work. Turned off by political and economic instability, talented individuals educated in their own countries often leave if they have the means to do so. The region is experiencing a notable "brain drain." This is the case despite the possibility that Latin Americans working in U.S. companies may find it more difficult to move up in those companies than they would in their own country. Were they willing to return to their own country, their education and experience would give them an advantage. In order to regain these professionals, countries need to establish an environment of political stability, economic opportunity, and physical safety.

How easy will Latin American countries find it to jump-start or leap frog in IT? In the same way that Costa Rica jump-started itself with Intel, could other countries in the region jump-start themselves by attracting an Oracle, an AOL, or a Microsoft? The answer is "possibly," but certainly companies need to have incentives to locate there. Given the right human capital mix, political stability, and legal systems that provide protections from corruption, tax incentives might help attract such companies. However, the first three attributes are hard enough to achieve, and now countries, like Brazil, may want to preserve their tax base at any cost.

Looking ahead twenty years, will there be large-scale trade wars and protectionism associated with intellectual property rights in the region? If there are more "local" companies with the incentive to protect intellectual property, then perhaps current obstacles will be more likely to be resolved. What is needed, then, is leadership from national companies. Over the long run, IT can promote more accountability and transparency in government, increased participation, and improved service delivery for a larger fraction of the population. Over a still longer term, information technology may also facilitate an increasing decentralization of political power.

Socially, the growing income inequality that seems to result from differential access to and use of IT need not be entirely bad so long as economies grow as a

whole. The key issues are how much inequality can be managed and over what time period. Now, the whole continent has commodities and human capital that are not as valuable anymore. Those economies that are able to retool will probably grow, and those that do not are likely to get left behind – creating more uneven regional growth. In this respect the Andean region is headed for trouble, while southern Brazil seems to have the ingredients for success. It is worth noting that the “new economy” did not just appear in one day in the United States; making the economy more flexible has been a long process. While it is tempting to hope that other parts of the world can catch-up quickly, it is important to ask what is an acceptable time horizon for Latin America?

Focusing on Human Capital

The second group accepted the premise that the knowledge-based economy will shape the future of Latin America. Who, then, are the technically proficient people, and where do they come from? Where do they go? Are there patterns that differ across subregions?

Surely, there are points of light, like Monterrey Tech or *Enlaces*. Argentina has many young entrepreneurs who are computer proficient, many of whom are of immigrant origin, although not first generation. The diversity of Latin American populations creates some distortions in educational policy. For instance, the most important cleavage remains that between the “Europeans” and “non-Europeans” – that is, between people of Spanish and indigenous origin. Countries with a predominantly indigenous population (the Andean countries) seem at a disadvantage. Mexico is the only country with a large indigenous population that has pursued an integrationist policy.

Another point of light is the emergence of business schools in Latin America over the past decade. Now there are opportunities for smart young Latin Americans to stay in their own countries and get a good technical education. Previously, the influence of the Cuban revolution had fostered a bias against business education. This view changed when Latin American graduate students stopped going to Europe and began attending U.S. universities. Unfortunately, many of the Latin Americans educated in the United States choose to stay there, despite opportunities at home. Currently, many Latin Americans are with Wall Street firms, steeped in the entrepreneurial culture. There is now a depth of qualified people: although they now reside in the United States, they are a latent resource for Latin America.

If the information revolution is conceived of in three categories – creating technology, embodying it in objects, and using services based on those objects – the outliers in the Caribbean plainly are in the third. They use IT in banking, a classic content service. In Costa Rica, Intel is assembling objects, chips. The debate about whether Costa Rica has done more than create an IT *maquiladora* will rage on, but it is somewhat beside the point. If the Costa Ricans are doing no more than selling their labor, that may be to the nation's good if that labor is employed more profitably by Intel than by other existing industries. And aside from Intel, major IT applications in Costa Rica support the logistics of the tourism industry.

That reinforces the point that Latin American countries do not have to *create* IT to find their way in the global economy. Most, perhaps all of them, do not have the conditions necessary to create IT. Rather, they need to *use* it effectively, which means adapting and perhaps creating content. Both business and government are trying to become more effective users of information technology, with the former in the lead. Cisco is one example of an effective user (in Latin America). In information technology, the big value added is in software and services, not hardware. In Latin America, services are exploding – mostly because big multinationals are teaming up with local companies, for instance, Mexico's Telefonica with Ariba. There are two sources of venture capital: (1) local companies; and (2) international venture capital; for instance, Chase Capital Partners funded Star Media and other start-ups.

The region also has the opportunity to produce content, given the large market for it not only in Latin America but also throughout the entire Spanish-speaking world. Is there enough connectivity to develop content in Latin America? Perhaps, for not much connectivity is needed to develop content, but a great deal more is needed to distribute it. In any case, Latin America will have to compete with Miami in producing content. Today, Miami has an advantage over Latin American locations, although some local presence is needed.

Finally, because Latin American has only nascent stock markets, an interesting indicator of Latin American IT might be how many Latin American companies are listed in the NASDAQ. The number is small, a measure of the distance that Latin America still has to go; one research firm put it at 14 (listed in www.ig.com). Some large Latin American companies have set up their own venture capital subsidiaries, but these can be regarded only as precursors, not alternatives to companies listed on the NASDAQ.

A related issue is what it takes to set up a start-up in Latin America. It is very difficult. While in the United States most R&D funding comes from the private

sector (and government money is concentrated on "R"), in Latin America the opposite is true: R&D spending is very small and largely government-driven. In Mexico, about 80 percent of R&D is funded by the government. Moreover, governments tend to allocate funds to larger enterprises, even though the sources of IT innovation often are the small start-ups.

Bottom Lines

These discussions elaborated familiar themes: if the right human capital mix, political stability, and legal systems that provide protections from corruption are the preconditions for developing IT, those preconditions are daunting. If those are present, then tax incentives might lure an Oracle, but most countries of the region seek to protect their tax base, not give it away as an incentive. Again, it is worth remembering that the goal for most of the region is not creating IT, but using it.

The time horizon is also critical. The new economy did not appear instantly in the United States; it took time to develop. By the same token, no Latin American country can hope to catch up overnight. But, over time, the points of light can become stronger. Currently, a number of Latin Americans are with Wall Street firms, steeped in the entrepreneurial culture. This depth of qualified people may now reside in the United States, but it is a latent resource for Latin America. The opportunity to produce content is there, and venture capital is beginning. Surely, as with past growth, IT-led progress will be uneven. The Andean region is headed for trouble, while southern Brazil seems to have the ingredients for success. The unevenness will raise the issue of how much inequality can be managed and over what time period. Over the long-term, information technology is also likely to bring an increasing decentralization of political power.

9. Looking Forward

Chair: Gregory Treverton, RAND

Over and over, the conversation returned to the question of whether Latin America will be able to provide the stability, safety and opportunity that IT requires. Yet, stability and safety will facilitate development in any sector, and so phrased this way, the prerequisites of IT are no different than those for development more generally. The challenge becomes a cultural and political one, not a technological one. Thus, it is worth pausing, in looking ahead, over what is distinctive about IT and about Latin America.

In one sense what is distinctive about IT is that it would seem to depend *less* on location, less on stability and safety than almost any other industry. It is possible to make the artifacts of IT, save for hardware and chips, without putting much fixed capital at risk. All that is really needed to run a first-rate software house, besides talented people, are some PCs, a few phone lines, a middling reliable electrical supply, and roof over your head. The same is the case for many IT-based services. The very essence of the information revolution is that people can get rich without building big, immobile factories. In an odd way, then, IT would seem the ideal sector for politically and socially unsettled countries. If things go bad, entrepreneurs can take their start-ups elsewhere. In this sense, Latin America might be able to circumvent obstacles in politics or infrastructure. To be fair, though, even if initial innovation can be done on a shoestring with hardly any fixed capital, converting, say, software into a real service requires more organization to provide updates, support and the like.

And location still matters.¹⁴ In some cases it matters because it is convenient to locate near ancillary services – finance in New York, or film production services in southern California. Yet precisely because the infrastructure requirements of IT are so limited, entrepreneurs can locate where they please. They are not dependent on minerals or electric power or even, in many cases, on large pools of labor. They can locate where life is safe and pleasant, or choose to be close to

¹⁴ See, for instance, Porter (1998) for a discussion of geographical clusters of IT-related businesses.

the comfort of ethnic kin or to the stimulation of peers. Cost of living may be a secondary consideration, and so Silicon Valley, Seattle, and Miami continue to be attractive despite the expense of living there.

Latin America would still seem to have advantages in producing IT content for the Spanish-speaking world. Yet at the high end of that content market, the infrastructure advantages of Miami, or Hollywood, are considerable. To those infrastructure advantages are added the benefits conferred by the presence of a large, relatively affluent, Spanish-speaking market close to home; by one estimate, the "GNP" of the 15 million Mexicans and Mexican-Americans in the United States equals that of the 100 million Mexicans in Mexico. To the extent that content needs to be closely tailored to particular countries, then there is no "Spanish-speaking" market, but the infrastructure and financing advantages of U.S. locations still may be significant, especially at the high quality end.

The role of universities in creating IT clusters elsewhere in the world is plain. Why has there been no Latin American IT success story? Surely, culture is important, but the role of universities is key: witness Silicon Valley or Route 128 in the United States. India produces 300,000 graduate software engineers a year, and a fifth of those come to the United States. The conversation during the conference kept returning to knowledge and to universities: Monterrey Tech is good but focused more on business than science; Brazil is improving; Chile is good, and Argentinean biological sciences are promising.

How is Latin America distinctive, for all the variations across the region? While it lags behind Asia on IT indicators, Asia does not look better in terms of building democracy. So far, though, that difference does not seem to have much relevance. To the extent that physical infrastructure matters, Latin America's, while inadequate, is not as bad as that in Africa and parts of Asia. It is worth remembering that the penetration of some new technology is not the same thing as making it in the new economy. And so the conversation kept returning to human capital and to the role of government. At this point, the role of government in Latin America seems more of an impediment than an advantage.

If education and the role of government are explicit and over-arching themes in Latin American approaches to both development and IT, the nature of the region's connections to the United States are, as always, a powerful implicit theme. Mexico weathered the financial crises of the 1990s better than other regions because it was so closely tied to a booming U.S. economy. Is it such a bad thing that all the cable lines run north and south, if Latin America is trying to develop technologically? If the region is to integrate into a global economy, its

technical people need to be connected to the top of the game, and that top is now Silicon Valley.

Yet if Latin America becomes more and more a piece of the U.S. economy, it may be able to have a piece of the action, but can it have its own action? Can it lure and keep its best and brightest at home? Can any country in the global economy? If the region progresses, but the gap between rich and poor continues to widen, then what? Latin American did not close the gap during the industrial revolution, so it would be rash to imagine that it will during the information revolution. Better IT will make the gaps more vivid for citizens. It is worth remembering, though, that the lead times were long for the United States as well – 10-15 years or more for major advances in IT – and inequality increased in the United States as well.

Looking out two decades, is it possible to imagine Latin America “opting out” of what it perceived as an unfair global regime? What would “opting out” mean? Suppose it decided to use new GMO seeds but not pay for them. The foreign companies presumably would simply stop selling them, and Latin America would be left to fend for itself. If Latin America managed to produce some intellectual property (IP), it might seek not just good IP protection but also barriers to imports. Desires for national or regional autonomy will persist, and they will continue to lure Latin American nations in the direction of policies, like protection and import substitution, that may produce autonomy but at the price of poverty. In the world of the global information economy, to “opt out” is to opt for poverty. Autonomy means not disconnecting but trying to structure niches and connections to the global economy in a way that will provide maximum national advantage.

Appendix

A. Conference Participants

Dr. Robert H. Anderson (UNITED STATES)
Senior Information Scientist and Head, Information Sciences Group, RAND

Mr. Fulton T. Armstrong (UNITED STATES)
National Intelligence Officer for Latin America
National Intelligence Council

Mr. Diego Arria (VENEZUELA)
Chairman, Technology Holdings International
Former Permanent Representative of Venezuela at the United Nations

Dr. John Baskin (UNITED STATES)
Deputy National Intelligence Officer for Economics and Global Issues
National Intelligence Council

Dr. Tora Kay Bikson (UNITED STATES)
Senior Behavioral Scientist, RAND

Professor Antonio Jose Junqueira Botelho (BRAZIL)
Department of Politics and Sociology
Pontifical Catholic University of Rio de Janeiro

Mr. Juan Enriquez (MEXICO)
Researcher, David Rockefeller Center for Latin American Studies,
Harvard University
Formerly CEO of Mexico City's Urban Development Corporation,
and Coordinator General of Economic Policy and Chief of Staff
to Mexico's Secretary of State

Dr. Lawrence K. Gershwin (UNITED STATES)
National Intelligence Officer for Science & Technology,
National Intelligence Council

- Dr. David Gordon (UNITED STATES)
National Intelligence Officer for Economics and Global Issues
National Intelligence Council
- Dr. Eugene C. Gritton (UNITED STATES)
Director, Acquisition and Technology Policy Program, RAND
- Dr. Timothy Heyman (MEXICO)
President, Heyman y Asociados, S.C., Mexico City
Formerly President, ING Baring Grupo Financiero (Mexico)
- Dr. Richard O. Hundley (UNITED STATES)
Senior Physical Scientist, RAND
- Mr. Elliot Maxwell (UNITED STATES)
Special Advisor to the Secretary of Commerce for the Digital Economy
U.S. Department of Commerce
- Ms. Lee Mizell (UNITED STATES)
Doctoral Fellow, RAND Graduate School
- Mr. William T. Ortman (UNITED STATES)
Deputy National Intelligence Officer for Latin America
National Intelligence Council
- Mr. Jonathan Orszag (UNITED STATES)
Managing Director, Sebago Associates, Inc.
Formerly Assistant to the Secretary of Commerce and Director of the Office
of Policy and Strategic Planning, Department of Commerce
- Mr. Ricardo Peon (MEXICO)
Manager of Telecoms and Internet Investments,
Heyman y Asociados, S.C., Mexico City
Formerly Managing Director, Deutsche Bank Mexico
- Mr. Danilo Piaggese (ITALY)
Head, Information Technologies for Development Division
Inter-American Development Bank
- Professor Larry Press (UNITED STATES)
Chairman, CIS Department, California State University
at Dominguez Hills

Dr. Susan Kaufman Purcell (UNITED STATES)
Vice President, The Council of the Americas,
New York City

Dr. Angel Rabasa (UNITED STATES)
Senior Policy Analyst, RAND

Mr. David Rothkopf (UNITED STATES)
Chairman and Chief Executive, Intellibridge Corporation,
Washington, DC
Formerly Acting Under Secretary of Commerce for International Trade
and Deputy Under Secretary of Commerce for International Trade Policy
Development

Mr. Ricardo Setti (BRAZIL)
Brazilian journalist and Latin American business consultant

Dr. Brian Shaw (UNITED STATES)
Deputy National Intelligence Officer for Science & Technology,
National Intelligence Council

Mr. Eduardo Talero (UNITED STATES)
Principal Informatics Specialist and Informatics Procurement Advisor
World Bank

Dr. Gregory Treverton (UNITED STATES)
Senior Consultant, RAND
Senior Fellow, Pacific Council on International Policy

Ms. Regina K. Vargo (UNITED STATES)
Deputy Assistant Secretary of Commerce for the Western Hemisphere
U.S. Department of Commerce

Mr. Robert A. Vitro (UNITED STATES)
Intersectoral, Regional and Special Programs, Information Technology for
Development Division, Inter-American Development Bank

Professor Ernest Wilson (UNITED STATES)
Director, Center for International Development and Conflict Management,
University of Maryland at College Park

Mr. Robert Worden (UNITED STATES)
Federal Research Division, Library of Congress

B. Conference Agenda

Wednesday, November 1, 2000

- | | |
|-----------------|--|
| 8:30 am | Introduction to the Workshop
Lawrence Gershwin, National Intelligence Council
Gregory Treverton, RAND |
| 9:00 am | Starting Point: Basic Infrastructure and Trends
Facilitator: Gregory Treverton, RAND
Discussant: Larry Press, California State University <ul style="list-style-type: none"> • What is the profile of IT infrastructure across Latin America? • What are the dominant features of that infrastructure?
Which countries are leading, which lagging? What are the predominant differences across and within countries? |
| 10:15 am | Break |
| 10:30 pm | The Economic and Business Dimension
Facilitator: Gregory Treverton, RAND
Discussant: Jon Orszag, Sebago Associates
Discussant: Ricardo Setti, iG International
Discussant: Regina Vargo, Department of Commerce
Discussant: Timothy Heyman, Heyman y Asociados <ul style="list-style-type: none"> • What are the sources of financing for information technology and for new IT-enabled businesses and services? • Who are the major players? Are they national, regional or global? • Are there critical IT business clusters in the region? Where, and why have they developed? • What characteristics of the business environment in various countries facilitate or inhibit growth in the use of information technology and in new IT-enabled businesses? • How is e-commerce developing in the region? How are issues of intellectual property, encryption, standards, |

commercial and contract law, and the like being dealt with?
What are the main differences across countries?

- What are the driving forces of change? What are the main obstacles?
- Ultimately, what can be said about the impact of IT on the conduct of business and economic advance in the region?

12:00 pm

Luncheon Session

Keynote: "Latin America in an Age of Cyberpolitik"

David Rothkopf, Intellibridge Corporation

Commentary: "Information Revolutionaries"

Ernest Wilson, University of Maryland

1:30 pm

Break-Out Session: Regional Differences

Facilitator: Robert Anderson, RAND

Facilitator: Tora Bikson, RAND

Facilitator: Ernest Wilson, University of Maryland

- How does the economic and business dimension of information revolution differ across Latin America? What drives these regional differences?

2:45 pm

Report Back from Break-Out Sessions

Facilitator: Greg Treverton, RAND

3:45 pm

Break

4:00 pm

The Political Dimension

Facilitator: Gregory Treverton, RAND

Discussant: Diego Arria, Technology Holdings International

Discussant: Danilo Piagessi, IADB

Discussant: Antonio Botelho, Genesis Institute

- How different are the approaches of various governments in fostering, channeling, regulating or inhibiting the spread of information technology?
- How are politics and governance being affected by information technology? Is there a future for "digital democracy" in the region?

- Will information technology facilitate the creation of non-governmental organizations (NGOs) in the region?
- Is information technology likely to spur economic and/or political integration across the region?
- How should cybersecurity, information terrorism, and applications for illegal use be considered?

5:30 pm

Session Ends

Thursday, November 2

9:00 am

The Societal Dimension

Facilitator: Gregory Treverton, RAND

Discussant: Juan Enriquez, Harvard University

Discussant: Susan Kaufman Purcell, Council of the Americas

- How will IT affect human service delivery in Latin America over the next decade? How will it change health care, education, and other social services? How, if at all, will it change the balance between public and private providers? What will be the implications of the change?
- What social or cultural factors prominent in Latin America, if not necessarily unique to it, facilitate or inhibit the diffusion of information technology? How common are these factors across the region?
- Is the information revolution increasing economic inequalities in the region? Is it increasing social inequalities in this or other ways, for instance by accentuating rural-urban cleavages?

10:30 am

Break

- 10:45 pm Break-Out Session: Regional Differences**
- Facilitator: Robert Anderson, RAND
Facilitator: Tora Bikson, RAND
- How does the impact of information technology on politics and society differ across Latin America? What drives these regional differences?
- 12:00 pm Lunch and Keynote: "Issues Governments Face in Making e-Commerce Work"**
- Elliott Maxwell, Department of Commerce
- 1:15 pm Report Back from Break-Out Sessions**
- Facilitator: Greg Treverton, RAND
- 2:30 pm Break**
- 2:45 pm Wrap-Up: Putting it all together**
- Facilitator: Gregory Treverton, RAND
Facilitator: Robert Anderson, RAND
Facilitator: Tora Bikson, RAND
- What major themes emerged from this workshop?
 - How might the projections of Latin American information technology patterns compare with other regions of the world?
 - What are the key factors in or determinants of how Latin American's future plays out insofar as the information revolution is concerned? Are those the same as for other regions, or different?
- 3:30 pm Final Comments**
- Lawrence Gershwin, National Intelligence Council
- 4:00 pm Conference Ends**

Bibliography

- (Anderson and others, 2000) Robert H. Anderson, Philip S. Anton, Steven K. Bankes, Tora K. Bikson, Jonathan Caulkins, Peter J. Denning, James A. Dewar, Richard O. Hundley, and C. Richard Neu, *The Global Course of the Information Revolution: Technology Trends*, RAND, CF-157-NIC, 2000.
- (Cardoso and Faletto, 1979) Fernando E. Cardoso and Enzo Faletto, *Dependency and Development in Latin America*, University of California Press, Berkeley, 1979.
- (Enriquez, 2000) Jaun Enriquez, *El Reto de Mexico Tecnologia y Fronteras*, Planeta, Mexico DF, 2000.
- (Enriquez, 2001) Juan Enriquez, *As the Future Catches You*, Random House, New York, to be published.
- (Hundley and others, 1999) Richard O. Hundley, Robert H. Anderson, Tora K. Bikson, James A. Dewar, Jerrold Green, Martin Libicki, and C. Richard Neu, *The Global Course of the Information Revolution: Political, Economic, and Social Consequences*, RAND, CF-154-NIC, 1999.
- (Mexico, 1998) *Mexico Social: 1996-98 Estadísticas Seleccionadas*, Banamex/Accival, Division de Estudios Economicos y Sociales, Mexico DF, 1998.
- (Packenham, 1992) Robert A. Packenham, *The Dependency Movement: Scholarship and Politics in Development Studies*, Harvard University Press, Cambridge, MA, 1992.
- (Porter, 1998) Michael E. Porter, "Clusters and the New Economics of Competition," *Harvard Business Review*, November-December, 1998, pp. 77-90.
- (Schumpeter, 1942) Joseph A. Schumpeter, *Capitalism, Socialism, and Democracy*, Harper & Brothers, New York and London, 1942.
- (UNDP, 1999) *Human Development Report 1999*, United Nations Development Programme (UNDP), Oxford University Press, New York, 1999.
- (Wilson, 2001) Ernest Wilson, *The Information Revolution in Developing Countries*, MIT Press, Cambridge, MA, to be published.